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DEPARTMENT OF COMMERCE
BUREAU OF FOREIGN AND DOMESTIC COMMERCE
ROY S. MACELWEE, Director

SPECIAL AGENTS SERIES—No. 195

SWEDISH FORESTS, LUMBER INDUSTRY, AND LUMBER EXPORT TRADE

BY

AXEL H. OXHOLM
Trade Commissioner

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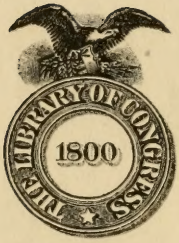

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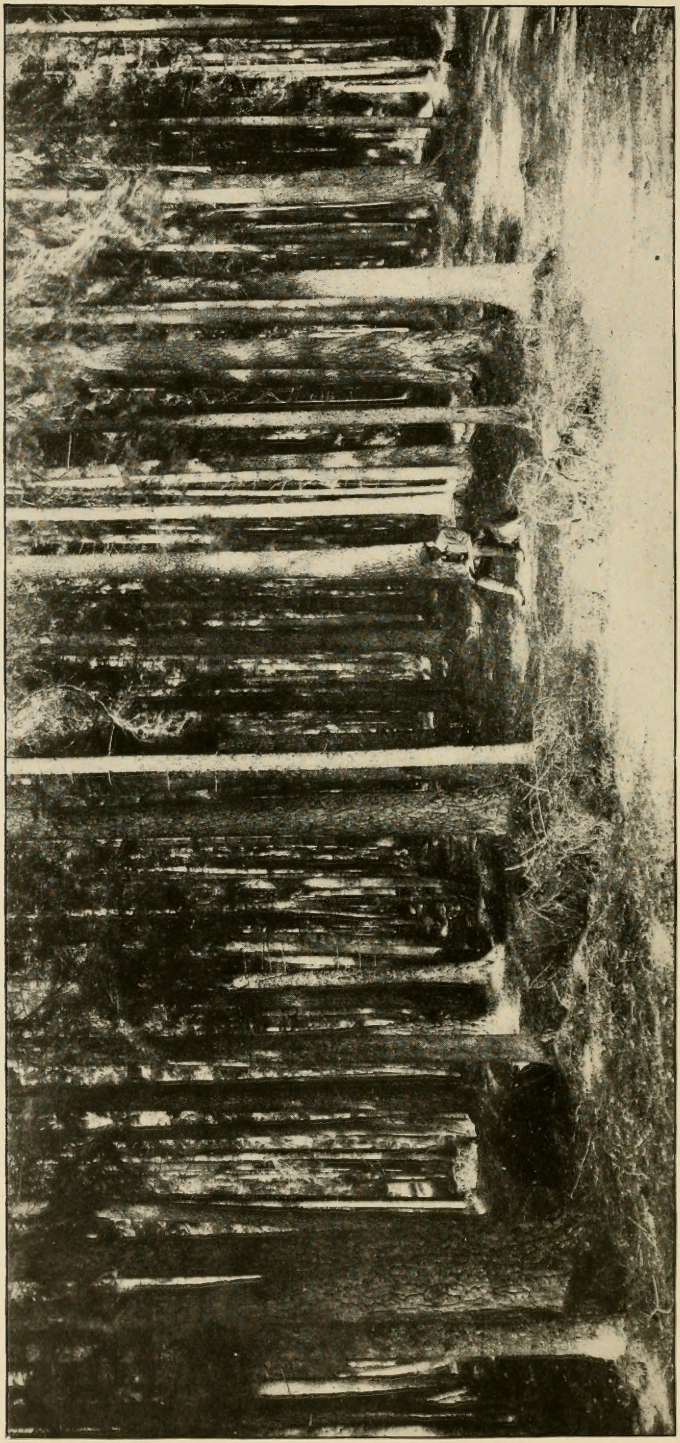

Courtesy of State Forest Laboratory, Stockholm.

FIG. 1.—JONAKER COUNTY FOREST, THE DENSEST MIXED STAND OF PINE AND SPRUCE IN EUROPE.

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LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE,
BUREAU OF FOREIGN AND DOMESTIC COMMERCE,
Washington, October 27, 1920.

SIR: There is submitted herewith a report on the forests, lumber industry, and lumber export trade of Sweden, by Axel H. Oxholm, a trade commissioner sent to investigate the Scandinavian lumber field jointly by various lumber associations and the Bureau of Foreign and Domestic Commerce. Reports by Mr. Oxholm will also be issued on Finland and on Norway.

Mr. Oxholm spent approximately eight months in Sweden, during which time he visited nearly every sawmill district in the country and, at the invitation of one of the principal exporters, even spent some time as a workman in a mill in order to gain a thorough knowledge of Swedish sawmill methods. Mr. Oxholm's work was greatly facilitated by the cooperation of the Swedish Government, principally through the Swedish Forest Service, of the Swedish Forestry Association and other institutions of forestry, and of the Swedish Lumber Exporters' Association. He also received valuable assistance from more than 1,500 lumber operators and business men in Sweden, all of whom showed great willingness to supply the data desired. Finally, acknowledgment is made to the United States Forest Service for preparing material for the report and also for reading the completed manuscript and making suggestions for its improvement.

Sweden holds the foremost place among the nations in the intelligent exploitation of forests, in sawmill management, and in lumber export methods. The forests represent so large a proportion of the country's total assets that the best efforts of the Government have been directed toward their conservation and effective utilization. With this backing from the Government, the main features of the Swedish lumber industry have come to be forest conservation, close utilization of raw material, accuracy in manufacture, and a definite export policy, worked out through many years' experience and strictly maintained. The consideration of the results attained in a country that has thus concentrated on the development of the lumber industry can not fail to be of interest and benefit to American forest owners, lumber manufacturers, and lumber exporters.

Respectfully,

ROY S. MACELWEE,
Director.

To Hon. J. W. ALEXANDER,
Secretary of Commerce.

SWEDISH FORESTS, LUMBER INDUSTRY, AND LUMBER EXPORT TRADE

INTRODUCTION.

A study of the forests, lumber industry, and lumber export trade of Sweden is probably the most interesting of its kind because Sweden occupies the leading position in the world in the lumber industry, not on account of the quantity produced, but on account of the scientific forest management and the efficient manufacturing and selling methods.

The climate and soil in Sweden are both very favorable to the growth of forests, and a large part of the country would be unsuitable for anything else. The total area of productive forests is 55,000,000 acres, of which public forests constitute 13,000,000 acres and private forests 42,000,000 acres. Stringent laws with regard to cutting are especially necessary in Sweden because of the supreme importance of the forests in the national life. A Swedish forest expert, C. A. Agardh, wrote in 1857: "It may be said that the position of Sweden as an independent nation and as a civilized country is contingent upon the existence or nonexistence of forests." These words were written before the lumber-export trade of the country was started on a big scale; they apply to present-day conditions perhaps even more strikingly than to those of the middle of the nineteenth century. During normal years before the war the exports from Sweden of forest products (timber, lumber, lumber products, pulp, paper, etc.) aggregated $90,000,000, or 44 per cent of the total exports. The Swedish Government accordingly considers the perpetuation of the forests of such vital importance that no one is allowed to endanger the future of the timber stands by reckless exploitation for the sake of immediate profit; and this point of view is so generally accepted that no difficulty has been experienced in connection with the Government's control of the cutting of timber on private lands. Possibly because the cutting is thus restricted and it is a matter of necessity to get the utmost value out of the cutting that is permitted, particular attention is paid in Sweden to the elimination of waste in the forests. High stumps are unknown. Top logs are rarely left in the woods. Swedish lumbermen not only have endeavored to obtain the highest possible prices for the main product, saw logs; they have also aimed at the closest possible utilization of the waste products of logging operations.

Approximately 20 per cent of the Swedish forests constitute broadleaf species and about 80 per cent coniferous species. The broadleaf species are of small importance, because the stands are scattered and the supply is insufficient to cover the needs of the country for hardwoods. The coniferous species afford important quantities of material for export, either as lumber or in the form of manufactured

products. There are only two species of coniferous woods of any importance, namely, pine (*Pinus sylvestris*) and spruce (*Picea excelsa*). The pine resembles the Norway pine of the Lake States, and the spruce that of the western coast of the United States; but the growth is smaller and the trees have more branches, so that the lumber produced is generally very knotty. On account of the northern location of the Swedish forests, the growth is dense and the texture of the wood is solid.

The age of maturity is reached at different stages in various parts of the country—in the most favorable cases, in 75 to 80 years, and in very extreme cases, in about 200 years. Most of the forests are located in northern Sweden, but southern Sweden is the largest producer of lumber at the present time, owing to the fact that this district is more densely populated. There are only a few virgin forests left, because the Swedish forests have been subject to exploitation for centuries.

Strict laws govern the management of the Swedish forests in all parts of the country. There is, however, no common law for the whole country, as climatic conditions have necessitated special laws for the different districts. These laws have to do with the cutting regulations and compulsory reforestation of cut-over lands. Lately, a law has been made to prevent the cutting of immature trees unless such cutting is necessary in order to improve the condition of the forests. Reforestation on a large scale has been carried on in Sweden by both private and public enterprise, because the forest owners in that country regard it as a commercial, paying proposition. The forest laws in Sweden and the methods of enforcing them offer much to interest the people of the United States, because conditions in Sweden are similar to those in some parts of this country.

Swedish forests will never be cut out. On the contrary, there is no doubt that under the present system of management the quantity of standing timber will be not only maintained but increased through reforestation, the drainage of swamp lands, and other measures.

A glance at the map of Sweden will immediately show the great advantage which that country has in its network of rivers; the distance from the place where logging operations are carried on to the nearest waterway is only a few miles. Practically every forest district has been exploited; there are only a few areas in the northernmost part of the country where cutting has not been carried on, owing to the fact that the rivers have been unsuitable for floating logs.

The cutting of saw logs is carried on only during the winter in order to prevent deterioration in the quality of the logs through discoloration. Stumps seldom exceed 3 inches in height in the forests, and the utmost care is given to the cutting of suitable log lengths and sizes, so that the best possible result will be obtained when the logs are cut into lumber. No logging machinery of any kind is generally used in Sweden, although American tractors have lately been introduced into that country for hauling logs. Until recently horses had been used exclusively. The logs are loaded on sleighs and taken on the snow to the nearest waterway, where they are piled on the river bank or on the ice ready to be dumped into the water in the spring. The floating of logs is usually carried on by a number of floating associations established by log owners in the various sections, the logs being floated for joint account.

No country equals Sweden in floating facilities, and the cheap transportation from the forest to the mill accounts for the fact that Sweden can effect a very close utilization of its forest products—closer than that of any other country, with the possible exception of Germany. Top logs, even down to one or two inches in top diameter, are bunched and strapped with steel wire and floated to the nearest charcoal plant, where they are converted into charcoal. The saw logs are, on an average, 6½ to 7 inches in top diameter and average in length about 17 to 18 feet. The logs are generally barked in the woods, in order to prevent an accumulation of bark in the river and at the mills, which would seriously hinder floating and otherwise cause considerable damage.

The manufacture of lumber in Sweden is characterized by the same careful utilization of material as the logging operations, so as to obtain the most profitable dimensions from the log, to minimize the amount of waste material, and to turn the waste material to useful purposes. Through years of experience the Swedish manufacturers have produced a type of machinery especially adapted to the Swedish conditions. Following the increased value of stumpage, their machinery has been constructed with a view to effecting the largest possible saving in raw material, and the gauge of the saw blades is always very small. All large mills are equipped with gang saws; only the smaller mills have circular saws. The gang saws give the best results because they saw lumber to exact sizes. Careful manufacture is the principal feature of the Swedish sawmills. The green lumber is given a certain excess to provide for shrinkage, and after it has been seasoned it has exactly the required dimensions. All guesswork has been eliminated from the Swedish sawing schedules, and the method of obtaining the most profitable dimensions of lumber has been calculated with scientific exactness. The various sawing systems employed are described in detail in this report. Particular attention is given to edging the lumber so as to obtain the largest possible sizes, because the price of lumber is determined by the size rather than by the thickness. The lumber is not trimmed in the mill. It is cut to almost any dimension according to English measurements. Metric measurements are seldom used in Sweden in connection with lumber for export. The lumber is edged on the half inch, and in thickness is cut to almost any size, but usually on the quarter inch.

The actual waste in the sawmills is negligible. Even the smallest piece of lumber is usually turned to some use. If too small to produce laths, broom handles, box shooks, etc., it is converted into charcoal or pulp. The sawmills are generally run in connection with pulp factories, and many mills also operate planing mills or box factories. The planing mills are equipped with Swedish planers, which show some excellent features in the way of saving material and producing perfectly smooth products. The operation of Swedish box factories, planing mills, and sawmills is based on the skillful utilization of the raw material. The profit of the operation may hinge, in many cases, on the thickness of the saw blades used.

Nearly all the Swedish mills season their lumber in the open air and it is never shipped without being air-dry. The seasoning thus requires two to seven or eight months, according to the season of the year and the location of the mill. The lumber is trimmed before

shipment. The trimming is effected on the odd and even foot and much attention is paid to trimming in such a way that the lumber will yield the highest economical result when sold. The mill ends are carefully collected and retrimmed and put up in suitable lengths from 1 foot (sometimes from 6 inches) to 5½ feet. This product is either sold to the local box factories or shipped in large quantities to foreign countries.

In regard to shipping, Sweden occupies a peculiar position, because the majority of the lumber shipping ports are closed by ice during several months of the year. Only a few ports can ship the year round. An interesting enterprise has just been started in Sweden to raft sawn lumber, and this promises a great deal for the future.

During late years the Swedish exporters have combined in selling for export. They maintain a strong organization and have minimum prices established to which all closely adhere. This association has laid down specific rules for the handling of lumber for export, and the Swedish exporters also cooperate with the exporters in the neighboring countries in regard to prices and selling conditions. The raw material and the cost of labor are too high in Sweden to allow any cutthroat competition, and the Swedish laws do not prevent combinations of manufacturers in order to stimulate prices. The Swedish lumber exporters have taken advantage of these conditions and have generally been in a position to obtain such prices as would give them a reasonable return on the investment. The market for Swedish lumber abroad is so firmly established that it practically sells itself without any great effort on the part of the Swedish exporters.

The general rule is to handle the lumber through foreign agents, but many firms prefer to let domestic agents handle their output on a commission basis. The location of Sweden, close to the most important lumber-importing countries, has enabled the Swedish exporters to keep in close touch with their trade, and they thoroughly understand the conditions abroad.

The prices of lumber have increased very materially since the war, as have the prices of stumpage and labor. The position of the Swedish lumbermen is now considered exceptionally good because the war and the high prices have enabled them to better their condition. It is believed that before the war the profits realized on the lumber export business generally were 6 to 8 per cent on the capital invested, which is not considered wholly satisfactory, having in mind the risk connected with the business.

The Swedish lumber exporters will probably maintain their position; but it is doubtful whether one may expect any increase over the present quantity of lumber for export from that country, because the forest resources are devoted, to a great extent, to the production of pulp, which generally offers more profit than lumber. It is improbable, therefore, that the exports of lumber from Sweden will exceed 2,000,000,000 feet annually, which has been the average figure in years past.

There is a marked difference between Swedish lumber and the principal species of American lumber exported to foreign markets. Swedish lumber is to be considered as good construction lumber; its many knots render it unsuitable for special purposes to which the

better grades of American lumber are adapted. The sizes of Swedish lumber run smaller than those obtainable in the United States. There should be no question, therefore, of serious competition between Swedish and American lumber if the exporters in both countries are thoroughly familiar with the character of the lumber exported. The best species of American lumber have sometimes been sold in foreign markets at the same prices as Swedish lumber; but this, no doubt, has been due, on the one hand, to the unfamiliarity of American exporters with the character of the lumber shipped from Sweden and, on the other, to the excellent Swedish manufacturing and marketing methods. There is a demand in most countries for American lumber, since it has qualities seldom or never found in lumber from other countries. The market is apparently so extensive that there is no need of cutthroat competition, since the accessible forest areas of the world seem to be limited in comparison with the demand for lumber and lumber products.

GENERAL DESCRIPTION OF THE COUNTRY.

Sweden (Sverige) is situated between 55° 20′ and 69° 4′ north latitude and between 10° 58′ and 24° 10′ east longitude. Sweden constitutes the eastern part of the Scandinavian Peninsula. The country is bounded on the west and north by Norway, on the east by Finland and the Gulf of Bothnia, on the south and southeast by the Baltic Sea, and on the southwest by the Cattegat, a branch of the North Sea.

The area of Sweden is 110,771,000 acres, or about 58 per cent of the area of the Scandinavian Peninsula. Of this area 9,336,000 acres (8.4 per cent) constitute inland water. The area of Sweden is somewhat smaller than the area of Spain or than the combined land areas of the States of Indiana, Ohio, Pennsylvania, New Jersey, and New York. The coast line is about 1,550 miles, the extreme length from north to south 980 miles, and the extreme width from west to east 310 miles. There are only two large islands, which are located off the southeastern coast—Gottland, with an area of 740,000 acres, and Oland, with an area of 330,000 acres.

Sweden is divided politically into 25 Provinces. The area of these Provinces and that of the largest four lakes is as follows:

Provinces and lakes.	Land.	Water.	Total.	Percentage of water.
	Acres.	*Acres.*	*Acres.*	
City of Stockholm	33,000	2,000	35,000	5.7
Rural district of Stockholm	1,826,000	86,000	1,912,000	4.5
Upsala	1,265,000	48,000	1,313,000	3.7
Södermanland	1,541,000	142,000	1,683,000	8.4
Ostergotland	2,464,000	266,000	2,730,000	9.7
Jonkoping	2,623,000	224,000	2,847,000	7.9
Kronoberg	2,201,000	248,000	2,449,000	10.1
Kalmar	2,708,000	144,000	2,852,000	5.0
Gotland	770,000	10,000	780,000	1.3
Blekinge	716,000	29,000	745,000	3.9
Christianstad	1,543,000	53,000	1,596,000	3.3
Malmohus	1,170,000	28,000	1,198,000	2.3
Halland	1,180,000	37,000	1,217,000	3.0
Goteborg and Bohus	1,210,000	37,000	1,247,000	3.0
Elfsborg	2,886,000	260,000	3,146,000	8.3
Skaraborg	1,995,000	100,000	2,095,000	4.8
Vermland	4,336,000	439,000	4,775,000	9.2
Orebro	2,062,000	195,000	2,258,000	8.7
Vestmanland	1,591,000	79,000	1,670,000	4.7
Kopparberg	6,978,000	436,000	7,414,000	5.8
Gevleborg	4,497,000	378,000	4,875,000	7.8
Vesternorrland	5,962,000	347,000	6,309,000	5.5
Jemtland	11,765,000	972,000	12,737,000	7.6
Vesterbotten	13,732,000	831,000	14,563,000	5.7
Norrbotten	24,380,000	1,695,000	26,075,000	6.5
Lake Wenner	.....	1,376,000	2,249,000	.....
Lake Wetter	.....	469,000		
Lake Malar	.....	282,000		
Lake Hjelmar	.....	122,000		
Total, Sweden	101,434,000	9,336,000	110,770,000	8.4

In this report the following terms will be used: Norrland (Northland), in northern Sweden, comprising the area north of the Dal River; central Sweden, the area south of the Dal River down to about 58° north latitude, comprising the regions surrounding the Great Lakes; southern Sweden, the area south of 58° north latitude.

Courtesy of State Forest Laboratory, Stockholm.

FIG. 2.—EXCEPTIONALLY FINE STAND OF PINE IN STATE FOREST.

Courtesy of State Forest Laboratory, Stockholm.

FIG. 3.—TYPICAL PINE FOREST IN NORTHERN NORRLAND.

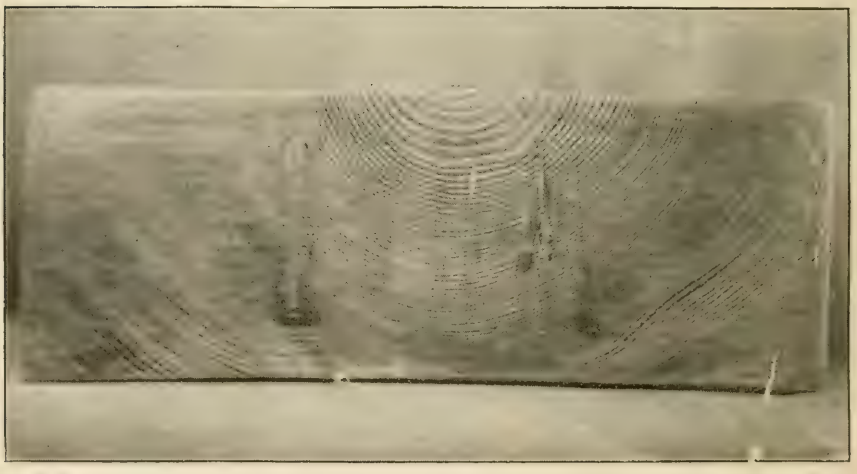


FIG. 4.—SECTION OF SWEDISH PINE.

TOPOGRAPHICAL CONDITIONS.

The mountainous districts in Sweden are found in the northwestern part, along the Norwegian border, and extend south to about 62° north latitude. This mountainous section is about 70 miles wide on the Swedish side. In the extreme northwestern corner this range (Kolen) attains its maximum heights, the highest peak being about 7,000 feet above sea level. Farther south the mountains decrease in height. From these mountainous districts the country gradually slopes in an eastern and southeastern direction toward the ocean. Low ridges and hills covered with forests are found in the rest of northern Sweden and the landscape is very similar to that of Finland. The altitude of this part of the country varies from 650 to 1,600 feet above sea level.

In the coastal district the country is level. In central and southern Sweden the country is rather undulating and grows more and more level toward the south. In the extreme southern part of Sweden the landscape is very similar to that of Denmark. The only highlands found in southern and central Sweden are the regions south of the Great Lakes in the interior, which constitute a plateau ranging in height from 600 to 1,200 feet. In northern Sweden large swamps are found, amounting in certain sections to more than 40 per cent of the total area.

The following table shows the area of different kinds of land in Sweden and the proportion of each kind to the total land area in 1915 and 1916:

Kind of land.	1915		1916	
	Acres.	Per cent.	Acres.	Per cent.
Cultivated areas	9,318,000	9.1	9,366,000	9.2
Meadows	3,205,000	3.3	3,073,000	3.0
Forests	55,640,000	54.8	57,240,000	56.5
Unproductive land	33,271,000	32.8	31,755,000	31.3
Total	101,434,000	100.0	101,434,000	100.0

The mountainous areas of Sweden are not very extensive, and the unproductive areas consist largely of marshes, peat bogs, etc. This unproductive area, no doubt, will be turned in time into forest land, and it is therefore of interest to consider the area of these peat bogs, etc., in the various Provinces. The area of the peat bogs and swamps in Sweden has not been definitely computed, but in 1912 it was estimated by Dr. Hj. v. Feilitzen to be as follows:

Provinces.	Acres.	Provinces.	Acres.
Rural district of Stockholm	49,000	Elfsborg	209,000
Upsala	111,000	Skaraborg	198,000
Sodermanland	74,000	Vermland	242,000
Ostergotland	198,000	Orebro	222,000
Jonkoping	362,000	Vestmanland	148,000
Kronoberg	310,000	Kopparberg	890,000
Kalmar	272,000	Gevleborg	593,000
Gotland	74,000	Vesternorrland	717,000
Blekinge	44,000	Jemtland	1,483,000
Christianstad	169,000	Vesterbotten	6,178,000
Malmohus	30,000	Norrbotten	
Halland	99,000		
Goteborg and Bohus	10,000	Total, Sweden	12,682,000

CLIMATIC CONDITIONS.

More than 15 per cent of the total area of Sweden is located north of the Arctic Circle, and in these sections of the country the climate is semi-Arctic. On account of the great distance from north to south, the climate necessarily varies a great deal in the different parts of the country. In southern Sweden the climate is mild.

Sweden is benefited to a great extent by the Gulf Stream and has a much milder climate than many other countries in the same latitude. Tobacco, for instance, is grown as far north as 59° north latitude, and sugar beets are produced in quantities large enough to supply the entire population with this commodity.

The mean annual temperature in the northern parts is below freezing point, while in the most favorable sections in southern Sweden it is about 45° F.

The following schedule gives the mean annual temperature (Fahrenheit) in different latitudes in Sweden:

Towns.	Latitude.	Temperature.	Towns.	Latitude.	Temperature.
	° ′	°		° ′	°
Karesuando	68 27	27	Stockholm	59 21	42
Umea	63 49	36	Kalmar	56 40	45
Hernosand	62 37	38	Lund	55 42	45

The highest temperature in the summer is about the same all over Sweden or about 80° F. and the lowest temperature in the winter is 49° to 59° below zero in the northernmost part of the country and about 4° below zero in southern Sweden.

Snow covers the ground about a month and a half in southern Sweden and up to six or seven months in northern Sweden. The lakes and rivers freeze in November and the ice melts 4 or 5 months later in southern Sweden and 5½ to 6½ months later in northern Sweden.

The ocean usually does not freeze on the west, south, and southeast coasts, but the entire Baltic has frozen over in extremely cold winters. The Gulf of Bothnia always freezes north of the Aland Islands, but a channel for traffic from Stockholm to Abo, Finland, is kept open by ice breakers. The ports south of Stockholm may be frozen for a short time in the winter, but during recent years navigation has been kept open almost the year round by ice breakers. The Gulf of Bothnia generally freezes at the end of November; the ice breaks in the northern sections in the latter part of May or the beginning of June, and farther south during the month of May or sometimes at the end of April.

The annual precipitation averages about 20 inches for the entire country and varies from about 17 inches in Norrland to 27 inches in the west coastal districts.

INTERIOR WATERWAYS AND RAILROADS.

About 8½ per cent of the area of Sweden is occupied by rivers and lakes. From the mountainous districts in the northwest many important rivers flow in a southeasterly direction, emptying into the Gulf of Bothnia. The rivers in central and southern Sweden are gen-

erally shorter and the majority of them either run through the Great Lakes or originate in the highlands of southern Sweden, running southwest, south, or southeast. For the lumber industry the rivers in northern Sweden are the most important, as they afford excellent facilities for transporting logs.

Fourteen of the most important rivers in Sweden drain 69 per cent of the total area. The largest 14 water systems, each draining more than 2,500,000 acres, are as follows, according to location from north to south:

Water systems.	Length.	Drainage area.	Water systems.	Length.	Drainage area.
Rivers in Norrland:	*Miles.*	*Acres.*	Rivers in Norrland—Contd.	*Miles.*	*Acres.*
Tornea	233	6,178,000	Ljungan	168	3,163,000
Kalix	208	4,423,000	Ljusnan	230	4,892,000
Lulea	193	6,227,000	Dal	283	7,215,000
Pitea	191	2,748,000	Water systems in central and southern Sweden:		
Skelleftea	205	2,866,000			
Umea	237	6,598,000	Malar-Norrstrom		5,510,000
Angerman	242	7,808,000	Wetter-Motalastrom		3,830,000
Indal	196	6,573,000	Wenner-Gota		11,985,000

In central Sweden there are several large lakes, the most important of which are Wenner (1,376,000 acres), Wetter (469,000 acres), Malar (282,000 acres), and Hjelmar (122,000 acres). In northern Sweden the lakes are fewer and smaller than those in central Sweden. The following are the largest lakes in Norrland: Storsjon (111,000 acres), Tornetresk (78,000 acres), Siljan (72,000 acres), and Hornavan (65,000 acres). The Klar River, which originates in Norway and is 228 miles long, empties into Lake Wenner. The Gota River runs out of this lake and empties into the Cattegat River. The total length of the whole water system of the Gota and Klar Rivers is 354 miles.

It is estimated in Sweden that about 3,500,000 horsepower can be harnessed before 1959. Up to the present time, about 1,000,000 horsepower has been developed. Water power is of great importance to Swedish industries, because the country has practically no coal.

Many of the waterways in Sweden have been improved to make them suitable for traffic; particularly in southern and central Sweden a network of canals has been constructed during the last 100 years, and it is now possible for small boats and barges to pass from the west coast through central Sweden over to the east coast. The total length of all canals in Sweden was 779 miles in 1917.

Several sluiced canals have been constructed, thereby enabling ships to pass up rivers where the traffic formerly was obstructed by waterfalls.

The two principal canals in Sweden are Trollhatte and Gota. Trollhatte Canal, south of Wenner Lake in the Gota River, is 52 miles long, 55 feet wide, and 14½ feet deep. It was built by the Government at a cost of about $7,500,000. Ocean-going steamers can now go up this canal to Lake Wenner and load at the mills on the northern shores of the lake. This is a very important means of transportation for the lumber for export from these regions, and the average annual freight passing through this canal in the last few years has been about 810,000 tons. The Gota Canal connects the two lakes, Wenner and Wetter, with the Baltic. It is 23½ feet wide and 9¾ feet deep, and cost about $4,000,000. About 265,000 tons of freight were trans-

ported through this canal annually in recent years. The average annual tonnage passing through the principal 10 canals in Sweden has amounted to 3,770,000 tons in recent years.

On the larger lakes in Sweden there is a heavy steamship traffic, which is concentrated mainly on the lakes in the central and southern parts of the country.

The railroad system covers mainly central and southern Sweden, where the largest part of the population is located and where the principal factories and industries are established. The total length of the Swedish railroads was 9,368 miles in 1917, of which the Government owned lines 3,268 miles in length. In northern Sweden an electric railroad, which has been in operation for a considerable time, is engaged in the transportation of iron ore to the ports in Norway and Sweden. Sweden has more railroad mileage in proportion to the population than any other country in Europe.

The railroads play an important part in the lumber-export trade, particularly for many interior sawmills in southern Sweden. In this part of the country the floating facilities are unsatisfactory and the transportation of logs and lumber is carried on almost exclusively by the railroads.

The railroad system in northern Sweden has not been very satisfactory, but new lines are under construction that will provide for better communication between the coast cities. An inland railroad also has been started, which will open up considerable forest areas for exploitation. In connection with this railroad construction, the Government is contemplating a more extensive colonization of this northern region.

INDUSTRIES.

The following figures (the latest available) show the number of persons in Sweden engaged in various occupations in 1910:

	Persons.
Agriculture and cattle raising	2,233,000
Fishing	39,000
Forest operations	94,000
Industry and mining	1,532,000
Commerce and transportation	579,000
Other occupations	1,045,000
Total	5,522,000

Agriculture is thus the principal activity in Sweden, although a comparatively small area is under cultivation. The value of the crops in 1917 was about $407,000,000 and in 1913 $230,000,000.

Cattle raising and dairying are important branches of agricultural activities. Although Sweden is an important producer of grain and foodstuffs, it is to a great extent dependent on the imports of these commodities from foreign countries.

Besides agriculture, the chief natural resources are the forests and the mineral deposits which, together with the waterfalls, constitute the principal bases of Sweden's economic activities. Only very limited quantities of coal are mined and there are no oil wells in the country.

Next to the agricultural activities, the lumber, pulp, and paper industries are the most important in Sweden and play a particularly

important part in Swedish export trade. These industries will be described in detail later in this report.

Mining is one of the oldest industries in Sweden, dating back more than 700 years. In the seventeenth and eighteenth centuries Sweden was the largest producer in the world of iron and copper. The Swedish iron mines are world famous, and the country also possesses copper, silver, zinc, and other metals. The value of the production of iron ore in 1917 was $22,500,000, and in 1911–1915, $13,900,000. The total value of the production of other minerals in 1917 was $3,900,000 and in 1911–1915 $1,100,000.

Sweden also has important metal-working industries, in which iron and steel products play the most important part.

Shipbuilding, machine works (sawmill and pulp-mill machinery is a specialty), and a number of other activities along these lines have developed very rapidly during the last half century.

The factory districts are located mainly in central and southern Sweden, where there is access to water power. The following table shows the value of production in different Swedish industries in 1913, 1915, and 1916:

Industries.	1913	1915	1916
Mining and metal products	$154,400,000	$189,500,000	$297,600,000
Peat, coal, stone, glass, cement, and other products	24,700,000	24,100,000	28,800,000
Lumber products	69,100,000	75,000,000	109,300,000
Pulp and paper products	60,600,000	70,800,000	118,300,000
Foodstuffs	151,400,000	193,800,000	233,300,000
Textile products	54,900,000	67,500,000	87,700,000
Leather and rubber products	26,300,000	51,200,000	57,900,000
Chemical products	25,700,000	39,400,000	58,000,000
Light and power plants	12,600,000	16,300,000	21,400,000
Total	579,700,000	727,600,000	1,012,300,000

MERCHANT MARINE AND COMMERCE.

The latest statistics, for January 1, 1919, give the Swedish merchant marine as follows: 1,079 sailing vessels, of 124,372 gross tons, and 1,605 steam and motor vessels, of 925,084 gross tons—a total of 2,684 vessels, of 1,049,456 gross tons.

Shipbuilding has grown mainly since the war started, and energetic steps are being taken by the Swedish shipowners to build up an adequate merchant marine, because it is realized what a great advantage it would be for the Swedish exporters to depend upon native-owned ships. (See chapter on Shipping.)

Nearly all the ports of Sweden are safe and well protected by islands. In the Gulf of Bothnia the tide is almost insignificant, and this circumstance greatly contributes to the favorable port conditions on the east coast of Sweden.

Until recently there have been no free ports in Sweden. Such free ports, however, are now being instituted at Malmo and Stockholm, and one is contemplated at Goteborg, mainly with the view of obtaining the transit trade to Russia after conditions have become settled in that country.

The western, southern, and southeastern coasts of Sweden are open the year round to navigation; but the other coastal districts of Sweden are handicapped by ice during the winter.

The following table gives the values of exports and imports of Sweden from 1905 to 1917, exclusive of the values of unwrought gold, silver, and coin:

Years.	Imports.	Exports.	Years.	Imports.	Exports.
1905	$153,781,000	$120,657,000	1912	$209,816,000	$203,806,000
1906	171,076,000	135,047,000	1913	226,872,000	219,049,000
1907	180,589,000	140,610,000	1914	194,543,000	206,991,000
1908	160,132,000	129,180,000	1915	306,191,000	352,786,000
1909	164,445,000	126,758,000	1916	305,136,000	417,109,000
1910	179,349,000	158,885,000	1917	203,307,000	361,679,000
1911	185,040,000	177,828,000			

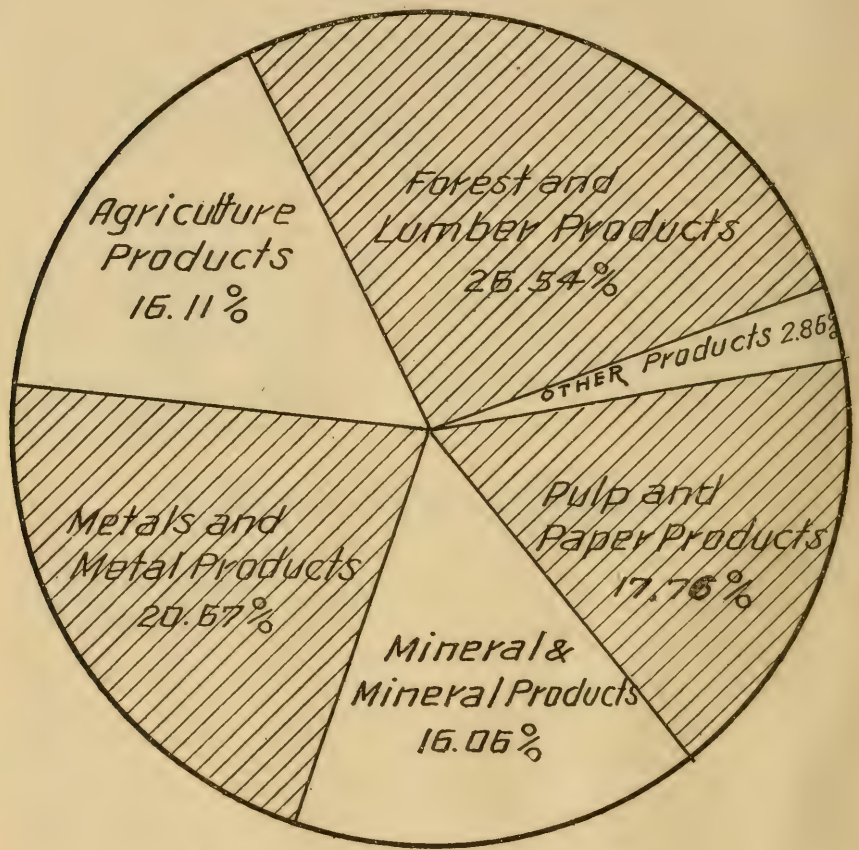

Agriculture Products 16.11%
Forest and Lumber Products 26.54%
Other Products 2.86%
Pulp and Paper Products 17.76%
Mineral & Mineral Products 16.06%
Metals and Metal Products 20.67%

FIG. 5.—Exports from Sweden in 1913, by groups of articles.

The principal commodities imported are grain, coffee, tobacco, and other foodstuffs; cotton and other raw materials for textile products; textiles, hides, lubricants, petroleum, rubber, dyestuffs, machinery, and large quantities of coal and coke.

The principal commodities exported are lumber and lumber products, pulp, paper, ore (mainly iron ore), metal and metal products, dairy products, matches, and stone for building and paving purposes.

POPULATION AND PRINCIPAL CITIES.

The population of Sweden on December 31, 1917, is given as about 5,800,000. The density of population for the whole country was 33½ inhabitants per square mile. The population varies from 200 to 250 inhabitants per square mile in the more thickly settled districts to only 5 to 7 inhabitants per square mile in the northernmost Provinces.

Besides about 25,000 Finns and 7,000 Lapps, who live in the northern districts of the country, there are about 40,000 inhabitants of other foreign nationalities and the remainder of the population (5,728,000) are Swedes. The Swedes belong to the Scandinavian branch of the Germanic race and are closely related to the Norwegians, Danes, and the Swedish-speaking people in Finland.

The language spoken is Swedish, which closely resembles Norwegian and Danish. In the northernmost districts of the country Finnish is spoken to some extent among the population along the Finnish border.

The emigration, particularly to the United States, has been considerable during the last half century. It is estimated that 700,000 Swedes now live in the United States.

The capital of Sweden is Stockholm, on the eastern coast, with approximately 413,000 inhabitants. Goteborg (197,000 inhabitants) is situated on the west coast and is the most important shipping port in Sweden. Malmo (113,000 inhabitants), on the southeastern coast, is important as the transfer point between Sweden and Denmark. Norrkoping (58,000 inhabitants), south of Stockholm, is a factory and shipping point. Helsingborg (45,000 inhabitants) is an important shipping and factory district on the southeastern coast of Sweden, south of Goteborg. Gevle (37,000 inhabitants) is an important lumber-shipping port north of Stockholm on the Gulf of Bothnia. Orebro (35,000 inhabitants) is a railroad center in central Sweden. Eskilstuna (31,000 inhabitants) is an important factory town in central Sweden, west of Stockholm.

The most important lumber-shipping ports in Norrland are Sundsvall (17,000 inhabitants), which is located in central Norrland, and Hernosand (10,000 inhabitants), located north of Sundsvall.

MONEY, WEIGHTS, AND MEASURES.

The Swedish monetary unit is the crown (krona, abbreviated kr.), which is divided into 100 ore. The monetary system is the same as that of Norway and Denmark. The par value of the crown in United States currency is $0.26799, and the equivalent of one dollar is thus 3.73148 crowns. The standard of value is gold.

The metric system of weights and measures is obligatory by law. In the lumber trade English measurements are usually employed.

PART I.—FOREST RESOURCES AND LOGGING AND FLOATING OPERATIONS.

FOREST RESOURCES.

Climate and soil combined make Sweden a typical forest country. Before the first settlers came the country was practically covered with forests. It was difficult for these settlers to clear the land, and until a few decades ago the people in the most remote parts of Sweden burned large areas of forest lands so as to clear them for cultivation.

Of the total area of Sweden, including inland water, about 57,000,000 acres, or 51 per cent, constitute productive forests. With the exception of Finland, Sweden has the largest percentage of productive forest land in Europe, where the average is 33 per cent. Sweden has approximately 960 acres of productive forest land per 100 inhabitants, and in this respect also it is ahead of the other European countries, except Finland; the average for Europe is 183 acres.

The productive forest area of the European countries, exclusive of Sweden, Norway, and Finland, is as follows, according to statistics compiled by G. Sundbärg, a Swedish forest expert:

Countries.	Productive forest land.	Percentage of total area.	Countries.	Productive forest land.	Percentage of total area.
	Acres.			*Acres.*	
European Russia	485,635,000	40.4	Bosnia and Herzegovina	5,622,000	45.5
Germany	34,585,000	26.2	Serbia	3,707,000	31.2
Austria	24,161,000	32.6	United Kingdom	2,871,000	3.7
France	23,529,000	17.8	Switzerland	2,115,000	21.3
Hungary	22,377,000	27.9	Greece	2,100,000	12.7
Spain	20,964,000	16.8	Portugal	1,557,000	7.1
Turkey	10,625,000	23.4	Belgium	1,285,000	17.7
Italy	10,269,000	14.6	Denmark	699,000	7.4
Bulgaria	6,400,000	27.0	Netherlands	635,000	7.9
Rumania	5,639,000	17.6	Luxemburg	190,000	29.7

The following table shows the forest area in each Swedish Province, together with the percentage of productive forest land of each Province in proportion to the total area of productive forest land in Sweden in 1915 and 1916, according to the Statistisk Arsbok (Statistical Yearbook) of Sweden for 1918 and 1919:

Provinces.	1915		1916	
	Productive forest area.	Percentage of total area of productive forests.	Productive forest area.	Percentage of total area of productive forests.
	Acres.		*Acres.*	
City of Stockholm	15,000	.....	17,000	.....
Rural district of Stockholm	1,135,000	2.0	1,158,000	2.0
Upsala	695,000	1.2	709,000	1.2
Sodermanland	996,000	1.8	998,000	1.7
Ostergotland	1,547,000	2.8	1,561,000	2.7
Jonkoping	1,490,000	2.7	1,512,000	2.6
Kronoberg	950,000	1.7	1,052,000	1.8

Provinces.	1915		1916	
	Productive forest area.	Percentage of total area of productive forests.	Productive forest area.	Percentage of total area of productive forests.
	Acres.		*Acres.*	
Kalmar	1,671,000	3.0	1,697,000	3.0
Gotland	384,000	0.7	391,000	0.7
Blekinge	357,000	0.6	370,000	0.6
Christianstad	643,000	1.1	647,000	1.1
Malmohus	141,000	0.3	143,000	0.3
Halland	346,000	0.6	368,000	0.6
Goteborg and Bohus	416,000	0.7	418,000	0.7
Elfsborg	1,853,000	3.3	1,926,000	3.4
Skaraborg	767,000	1.4	793,000	1.4
Vermland	3,363,000	6.0	3,385,000	5.9
Orebro	1,333,000	2.4	1,371,000	2.4
Vestmanland	912,000	1.6	932,000	1.6
Kopparberg	5,114,000	9.2	5,133,000	9.0
Gevleborg	3,669,000	6.6	3,663,000	6.4
Vesternorrland	4,706,000	8.5	5,054,000	8.8
Jemtland	7,308,000	13.3	7,910,000	13.9
Vesterbotten	7,410,000	13.4	7,503,000	13.2
Norrbotten	8,419,000	15.1	8,529,000	15.0
Total	55,640,000	100.0	57,240,000	100.0

About 65 per cent of the productive forest land in Sweden is located in the district of Norrland and Dalecarlia (the district adjacent to the Dal River). In this part of Sweden, however, approximately 17,000,000 acres of land are located above the timber limit, and Norrland also contains a large percentage of unproductive land, such as swamps, marshes, etc., so that the productive forest area in proportion to the total area is not very large in this part of the country. The Provinces having the largest area of productive forests in proportion to their total area are Vermland, Kopparberg, Gevleborg, and Vesternorrland. The southernmost Provinces of Sweden are now but sparsely forested, because the forests that once covered these areas have been cut out during the last few centuries in order that the land might be used for agricultural purposes.

FOREST REGIONS.

As a consequence of the different climatic conditions in northern and southern Sweden, the forest regions differ widely in character. The majority of the forest lands in Sweden will always be best suited for forestry, as the soil is often unfavorable for agricultural purposes. These conditions apply especially to the northern Provinces. About 85 to 90 per cent of the stands in the Swedish forests constitute coniferous species and 10 to 15 per cent broad-leafed.

The Swedish forests may be divided into three distinct forest regions. The north Baltic coniferous region covers the territory north of a line from the north shore of Lake Wenner to a point about 50 miles north of the Dal River; in other words, practically the entire territory of Norrland and the district of Dalecarlia. The south Baltic coniferous region starts immediately south of the north Baltic coniferous region and covers southern Sweden with the exception of the southernmost parts; namely, Skane and part of the Provinces of Halland and Blekinge. The Central European beech region covers the extreme south of Sweden.

NORTH BALTIC CONIFEROUS REGION.

The productive forest area of the north Baltic coniferous region comprises approximately 36,800,000 acres. Except in the southern part, where the mining industry was developed more than 700 years ago, using large quantities of charcoal for smelting ore, this region was not exploited for forest products until about 100 years ago. The exportation of forest products started on a large scale about 1850 to 1860, and the present development of the forests in these regions dates from this time.

FIG. 6.—Scandinavian forest regions.

At present nearly all the privately owned forests in this part of Sweden have been exploited. Only a few stands of virgin forests in private ownership are left. The State forests, however, which are very extensive in this part of Sweden, have not been much developed and consequently contain considerable overmature stands. These virgin forests are found in the less accessible interior districts; the coastal regions were the first to be exploited.

The northern parts of Sweden are sparsely populated, and the domestic consumption of wood, in these regions, is therefore much

smaller than in other parts of Sweden. Consequently the northern Baltic coniferous region in Sweden must have large quantities of wood available for export, and the ports in Norrland north of the mouth of the Dal River exported before the war about 75 per cent of the total quantity of lumber shipped from Sweden. Whatever happens in the line of agricultural development in the rest of Sweden, Norrland will always be primarily a timber-producing section.

The birch-forest region is found on the slopes of the mountains, along the Norwegian border. A few other broad-leafed species grow in these regions, but their importance is very small outside of furnishing fuel for local use. The growth of the trees in the mountainous regions is scrubby, and these regions are of no importance to the logging operations, because the stands are scattered and the logging facilities are usually unsatisfactory. Birch does not play an important part in the lumber-export industry of northern Sweden and consequently will not be considered in this report.

Below the birch region the coniferous species grow over almost all the rest of the north Baltic coniferous region, the only interruptions being swamps, cultivated areas, and inland water. The cultivated areas are not very large in this part of Sweden, and there are also comparatively few lakes.

There are only two species of coniferous trees; namely, pine (*Pinus sylvestris*) and spruce (*Picea excelsa*).

Pine and spruce are found in both clear and mixed stands. In some regions considerable birch is found mixed with pine and spruce. Clear stands of spruce are found principally on calcareous soil in the Province of Jemtland, certain sections of Vesternorrland and Vesterbotten, and some coastal districts. The districts adjacent to the Angermann River have extensive clear spruce stands. In the interior southern parts of Norrland there are also extensive clear stands of spruce. Pine is the predominant species all over these regions except in the districts mentioned.

Of broad-leafed species there are aspen (*Populus tremula*), alder (*Alnus incana* and *Alnus glutinosa*), basswood (*Tilia europæa*), maple (*Acer platanoides*), and a few other species. These species, however, are of no importance and are seldom found except scattered among the coniferous stands. Occasionally some small broad-leafed stands may be found along the rivers.

SOUTH BALTIC CONIFEROUS REGION.

Except on small areas of State-owned forest lands, there are practically no virgin forests left in the south Baltic coniferous region. The forests are all adjacent to the most densely populated sections of the country and have been exploited for hundreds of years.

Besides pine and spruce, there are small stands of oak (*Quercus robur*), but these stands are so small that they are not even sufficient to cover the local demand.

Other broad-leafed species are ash (*Fraxinus excelsior*) and elm (*Ulmus montana*), besides birch and the broad-leafed species growing in the north Baltic coniferous region.

CENTRAL EUROPEAN BEECH REGION.

The Swedish forests in the central European beech region are to a large extent planted. Beech (*Fagus sylvatica*) and oak constitute the

principal species of broad-leafed trees in this region, but the stands are not very important. Some limited stands of pine and spruce are also found, the spruce being planted. The forests in the Central European beech region and the south Baltic coniferous region were first exploited for exports of forest products during the Middle Ages. At that time the forests in western continental Europe had been badly cut out and these countries had to obtain their supply of lumber and timber from other parts of Europe. The forests in southern and central Sweden were extensively cut to furnish firewood, ship timber, and lumber. Considerable quantities of oak were cut, especially in the coastal regions. Large areas also were burned over, and to-day these areas are still to a large extent bare of forests.

With the growing population in southern and central Sweden, the capacity of these regions to supply forest products for export diminished and they now consume locally the largest part of their production of wood, although they probably produce larger quantities of wood than the north Baltic coniferous region.

To the lumber export trade, the north Baltic coniferous region is therefore of principal interest, and it will be given special attention in this report.

SPECIES.

PINE.

Pine (*Pinus sylvestris*) [1] grows best on dry, sandy soil and is found up to an altitude of 1,300 feet in the northern part of Sweden. The timber limit is increased to about 2,950 feet at 62° north latitude. Another species of pine (*Pinus montana uncinata*) grows only in the southeastern coastal regions and is of little importance to the lumber industry.

Of *Pinus sylvestris* there are two varieties, *Pinus sylvestris lapponica* and *Pinus sylvestris septentrionalis*. For practical purposes it may be said that the *lapponica* variety grows in the north Baltic coniferous region and the *septentrionalis* variety is found in the south Baltic coniferous region. The principal distinguishing qualities of these two varieties are as follows:

Lapponica variety.—The needles are short and wide; they average in length, $\frac{50}{64}$ to $1\frac{62}{64}$ inches. The shape of the crown is cylindrical and the branches are short. The color of the bark is yellowish red and it is thinner than that of the *septentrionalis* variety. The wood is dense and of a reddish color, showing a larger percentage of heart than is possessed by the *septentrionalis* variety. It is supposed that the *lapponica* variety has come in from eastern Europe. The difference in the quality of the wood between these two varieties may be attributed to the location and the climate.

Septentrionalis variety.—The needles are $1\frac{11}{64}$ to $2\frac{23}{64}$ inches long and are narrow. The shape of the crown is pyramidical. The bark is darker and thicker than that of the pine growing in the north Baltic coniferous region. This variety of pine probably came into Sweden from central Europe, because it shows many of the qualities of the pine in those regions.

The average height of the pine tree in different parts of Sweden is as follows: Norrbotten, 56 to 59 feet; Norrland, 59 to 66 feet; central

[1] North European pine is called redwood in the European markets.

Courtesy of Forester O. Eneroth.

FIG. 7.—EIGHTY-FIVE-YEAR-OLD STAND OF PINE AND SPRUCE, 7,000 CUBIC FEET PER ACRE, DALECARLIA DISTRICT.

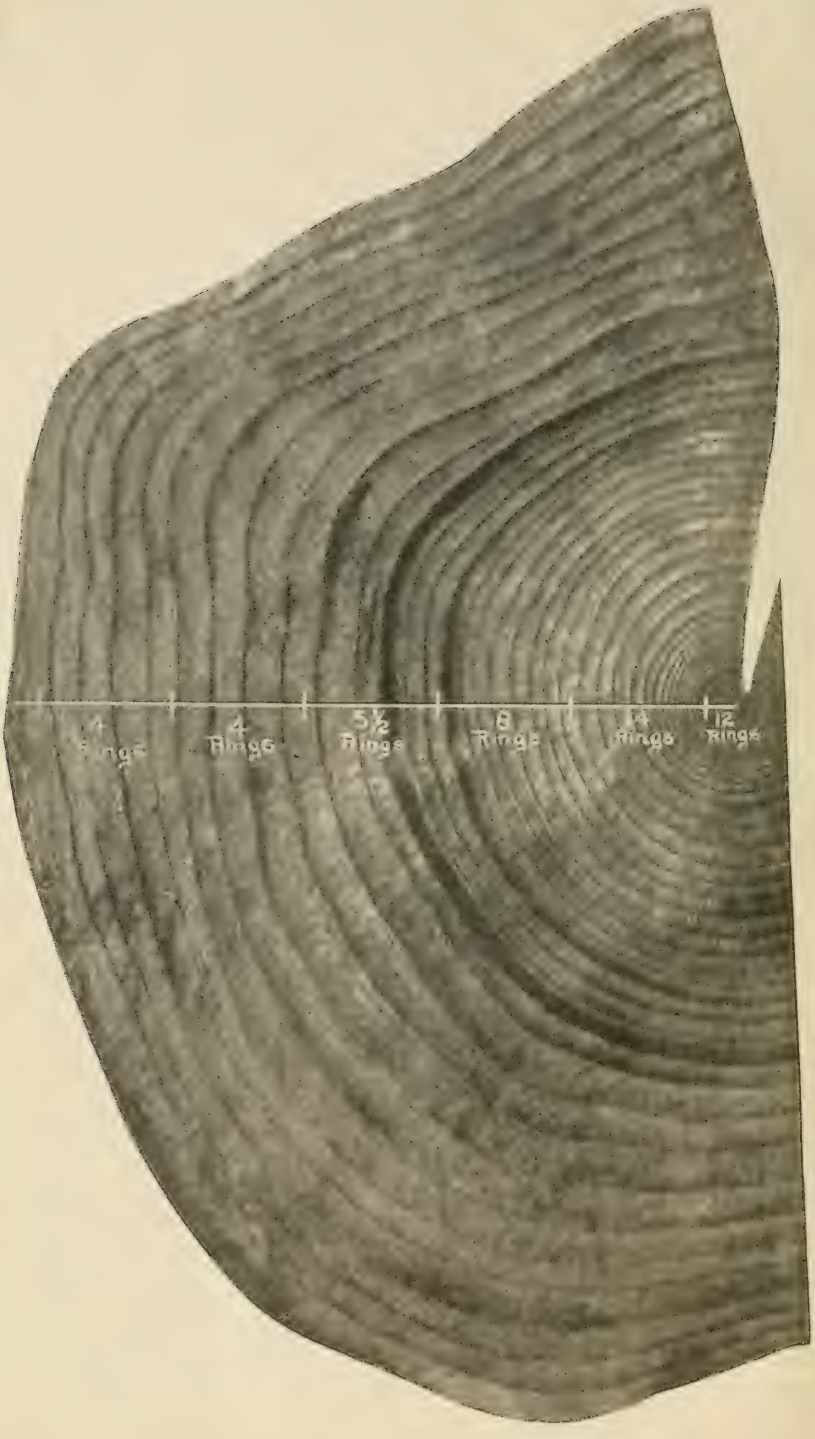


FIG. 8.—CROSS SECTION OF SWEDISH SPRUCE.

and southern Sweden, 66 feet. The maximum height of any pine tree recorded in Sweden is 108 feet.

The pine grows most rapidly in height during the period from 20 to 50 years of age. At the age of 120 to 150 years the growth in height stops. Pine trees may occasionally be found from 300 to 500 years old, but this is very unusual. Trees more than 36 inches in diameter at breast height are seldom or never seen.

The following figures compiled by Forester Örtenblad, of the Swedish Forest Service, show the diameter at breast height of pine 70 years old in the different parts of Norrland and Dalecarlia: Vesterbotten, $7\frac{3}{64}$ inches; Jemtland, $8\frac{43}{64}$ inches; Vesternorrland, $8\frac{5}{64}$ inches; Gevleborg, $8\frac{7}{64}$ inches; Kopparberg, $7\frac{61}{64}$ inches. In southern Sweden the growth of the trees is much quicker. At the age of 140 to 200 years pine has a diameter at breast height of approximately $12\frac{1}{4}$ inches.

The average age of maturity of pine stands (based on the age at which suitable saw-log dimensions can be obtained) is as follows in different parts of the country: Southern Sweden, 80 to 90 years; central Sweden and southern Norrland, 90 to 120 years; central Norrland and northern Norrland, 120 to 180 years.

The pine has a tap-root system that extends far down into the ground and makes the tree resistant to wind and fire. The stands are not so dense as those of the forests commonly seen in the United States, and in open stands the branches are heavier and more numerous than in denser stands. The pine growing near the coast and in the higher altitudes is lower and more branched.

The taper of the pine may be 1 inch in 10 feet in the best stands, but in the mountainous districts and near the coast the taper is greater.

The taper of pine and spruce is given as follows, covering stands in central Sweden and southern Norrland: Average stand—1 inch in 8 feet for first 22 feet from ground, then 1 inch in 6 feet; average good stand—1 inch in 10 feet for first 26 feet from ground, then 1 inch in 8 feet; poor stands (coast and mountain pine and spruce)—1 inch in 6 feet for first 18 feet from ground, then 1 inch in 4 feet.

The thickness of the bark in trees of different diameters in central Sweden is as follows:

Diameter at 4½ feet from ground.	Thickness of bark.
Inches.	*Inches.*
$1\frac{22}{64}$	$\frac{6}{64}$
$1\frac{23}{64}$ to $3\frac{49}{64}$	$\frac{11}{64}$
$3\frac{50}{64}$ to $5\frac{58}{64}$	$\frac{20}{64}$
$5\frac{59}{64}$ to $7\frac{76}{64}$	$\frac{27}{64}$
$7\frac{77}{64}$ to $9\frac{94}{64}$	$\frac{36}{64}$
$9\frac{95}{64}$ to $11\frac{113}{64}$	$\frac{44}{64}$
$11\frac{114}{64}$ to $13\frac{130}{64}$	$\frac{52}{64}$
$13\frac{131}{64}$ to $15\frac{148}{64}$	$\frac{60}{64}$
$15\frac{149}{64}$ to $17\frac{166}{64}$	$\frac{67}{64}$
$17\frac{167}{64}$ to $19\frac{183}{64}$	$1\frac{13}{64}$
$19\frac{184}{64}$ up.	$1\frac{14}{64}$

On an average the bark constitutes from 6 to 12 per cent of the cubical contents of the tree, but it may represent as much as 22 per cent.

The pine in Sweden is generally of a very dense and solid growth; the farther north the tree the more close-grained is the wood. In the extreme north the growth may be so dense that the annual rings can not be seen by the naked eye. On an average, the growth in Norrland may show from 12 to 15 rings per inch. The climate in southern Sweden is mild and the growth is much quicker. Large stands are found on watery land, where the growth of the pine is very similar to its growth in southeastern Finland. The texture is spongy. The pine in southern Sweden may have a growth of 6 to 8 annual rings per inch. Pine in northern Sweden shows a large percentage of heart and is of a reddish color; but the percentage of sapwood increases the farther south the tree grows. In southern Sweden the wood is almost white.

Pine contains from 2.5 to 5 per cent of resin in the sapwood and from 11 to 23 per cent of resin in the heartwood. The weight of pine, air dry, is given as 36 pounds to the cubic foot by Prof. Wijkander. The weight of a cubic foot of pine is estimated at 51.7 pounds, green, and at 31.9 pounds, absolutely dry. The shipping weight is computed at 46.7 pounds per cubic foot in the general trade.

Pine is essentially a construction material of excellent qualities. Practically the only defect is the knots, but these, though numerous, are usually small, solid, and firmly incased in the wood. Pine is not so hard as Douglas fir and southern yellow pine in the United States, but is considerably harder than the pine in central Europe. It is easily worked with tools and does not warp or check. On account of the resin content pine has very good lasting qualities. This wood is not well adapted for interior finish, partly because it does not show any decorative grain, and the knots make painting necessary when the wood is used for such purposes. Nevertheless, it is extensively used for joinery, but spruce is believed to be more suitable, though it has some of the same defects. The pine in Sweden is supposed to be less knotty than the pine in Norway and Finland, but otherwise there is very little difference in the quality of the wood in the three countries. The distinction made in the lumber-export trade between pine from Norway, Finland, and Sweden is due largely to differences in manufacturing and grading and not to differences in quality.

The pine in Sweden may be compared with the Norway pine (*Pinus resinosa*) of the Lake regions of the United States, but it is believed that Swedish pine has superior qualities as a construction wood because it is more close-grained.

The best stands of pine are found in the interior districts of central and southern Norrland and of Dalecarlia.

Particularly in Norrland, considerable quantities of dead pine timber are found. These trees have only the heartwood left, the sapwood having decayed. They have been standing for centuries; some have been seen in Norrland bearing the inscription of the year 1704. The supply is rapidly being cut out in accordance with the accepted principles of rational cutting. Probably in 10 years this class of timber will not be found in Sweden in large quantities. This timber is called "torrac" in the international lumber trade. The lumber sawn from these trees has special lasting qualities and is therefore used extensively for construction purposes such as docks, etc. Its quality is very poor, and it is classified as cull lumber.

SPRUCE.

Spruce (*Picea excelsa*),[2] it is believed, came into Sweden from eastern Europe. The best spruce stands are found on calcareous soil, and this species prefers moisture, but can not endure the heat as well as the pine and is more exacting in its requirements regarding climate and soil.

There is only one native species of spruce in Sweden; a great many foreign species of spruce have been planted, but they do not play any important part in the lumber-export industry.

The average height of spruce at the ages of 100 and 200 years in the different parts of Norrland and Dalecarlia is seen from the following table:

Districts.	100 years.		200 years.		Districts.	100 years.		200 years.	
	Ft.	*In.*	*Ft.*	*In.*		*Ft.*	*In.*	*Ft.*	*In.*
Norrbotten	46	10	60	0	Vesternorrland	57	9	71	0
Vesterbotten	55	9	68	6	Gevleborg	60	0	75	6
Jemtland	55	9	68	6	Kopparberg	58	0	72	0

The maximum height of spruce in the various parts of Norrland is as follows: Gevleborg, 102 feet 6 inches; Vesternorrland, 95 feet; Jemtland, 92 feet; Norrbotten, 85 feet.

The diameter of spruce at breast height at the age of 80 years is as follows in the different districts of Norrland and Dalecarlia, according to Forester Örtenblad: Vesterbotten, $6\frac{59}{64}$ inches; Jemtland, $7\frac{21}{64}$ inches; Vesternorrland, $7\frac{51}{64}$ inches; Gevelborg, $8\frac{43}{64}$ inches; Kopparberg, $8\frac{51}{64}$ inches. The average for Norrland at different ages is as follows: 30 years, $1\frac{26}{64}$ inches; 40 years, $2\frac{40}{64}$ inches; 50 years, $3\frac{52}{64}$ inches; 60 years, $4\frac{56}{64}$ inches; 70 years, $5\frac{55}{64}$ inches; 80 years, $6\frac{47}{64}$ inches; 90 years, $7\frac{31}{64}$ inches; 100 years, $8\frac{22}{64}$ inches; 110 years, $8\frac{53}{64}$ inches; 120 years, $9\frac{24}{64}$ inches; 130 years, $9\frac{59}{64}$ inches; 140 years, $10\frac{25}{64}$ inches; 150 years, $10\frac{55}{64}$ inches.

The growth of the spruce in southern Sweden is more rapid. The age of maturity of the spruce trees (based on the age when the tree yields suitable dimensions for saw logs) is somewhat earlier than that of pine. Spruce is often liable to decay, and it has been necessary in many parts of the country to cut spruce before the age of 80 years, when this rot generally begins.

The root system does not extend very deeply into the ground and is partly exposed above ground. Spruce is therefore liable to suffer from winds and forest fires.

The best stands of spruce are found in central Norrland. In dense stands the bole is perfectly straight, and there are fewer branches than when the spruce grows in the mountainous districts and near the coast. The bark is smooth and is of a dark grayish color.

[2] North European spruce is called whitewood in the European markets.

The thickness of the bark in trees of different diameters is shown in the following table:

Diameter at 4½ feet from ground.	Thickness of bark.
Inches.	*Inches.*
$1\frac{62}{64}$	$\frac{4}{64}$
$1\frac{62}{64}$ to $3\frac{60}{64}$	$\frac{9}{64}$
$3\frac{60}{64}$ to $5\frac{58}{64}$	$\frac{12}{64}$
$5\frac{58}{64}$ to $7\frac{56}{64}$	$\frac{14}{64}$
$7\frac{56}{64}$ to $9\frac{54}{64}$	$\frac{17}{64}$
$9\frac{54}{64}$ to $11\frac{52}{64}$	$\frac{20}{64}$
$11\frac{52}{64}$ to $13\frac{50}{64}$	$\frac{24}{64}$
$13\frac{50}{64}$ to $15\frac{48}{64}$	$\frac{26}{64}$
$15\frac{48}{64}$ to $17\frac{46}{64}$	$\frac{28}{64}$
$17\frac{46}{64}$ to $19\frac{44}{64}$	$\frac{30}{64}$

The needles are twenty-five sixty-fourths to fifty sixty-fourths inch long, and are dark green. The wood is white and of a solid and dense growth. Spruce has more knots than pine, but the knots are smaller and are firmly incased in the wood. Their light grayish color is not conspicuous. The wood contains only a very small percentage of resin, and is therefore liable to decay. The weight is given by Prof. Wijkander as 30 pounds per cubic foot, air-dry, while 48.4 pounds and 27.5 pounds are given by scientists as the weight of spruce, green and absolutely dry, respectively. The railroads figure the weight of spruce at 46.7 pounds per cubic foot, or the same as pine, but the spruce is actually lighter. Spruce bark contains from 5 to 18 per cent of tannic acid. The fibers are longer, but not so strong as the fibers of pine. The high percentage of cellulose in this wood and the small percentage of resin make it an ideal raw material for pulp, and spruce pulp is very soft and elastic.

The physical properties of spruce (breaking strength, hardness, etc.) are not so good as those of pine, and it is, therefore, not so adaptable for ordinary construction purposes. Its inferiority in lasting qualities restricts the use of this wood to purposes where it is not exposed to the elements. It is easily worked with tools, does not warp or check, and has many desirable qualities for interior finish and joinery. It has the same defects, however, as pine, such as knots and lack of decorative grain, and it is therefore generally painted when used for interior finish. It is an ideal shook material for boxes to be used as food containers, because the wood has neither taste nor smell.

The spruce in Sweden has a great many of the same qualities as the Sitka spruce on the Pacific Coast of the United States, but the small percentage of clears and the limited dimensions obtainable make the Swedish wood less useful than the American.

PHYSICAL PROPERTIES OF PINE AND SPRUCE.

The testing of the physical properties of wood has not been developed to such an extent in Europe as it has in the United States. In northern Europe few tests have been made, and little attention is paid to this important question.

A test of Swedish pine made in 1897 by Prof. Aug. Wijkander, in Goteborg, has been submitted to the Forest Products Laboratory at Madison, Wis., with a view to obtaining a comparative statement of the physical properties of Swedish and American pines. The accompanying table, prepared by the Forest Service, gives data for

comparing various American coniferous species with Swedish pine and spruce. Sources of the data and explanations of tests are indicated. The values for air-dry material of the American species are inserted for comparison with those of the Swedish species, for which values based on tests of green material are not available. Intercomparisons of American species should be based principally on the values for green material.

In making comparisons from this table it should be remembered that the material of any species is variable and that the species averaging highest will yield some material poorer than the average of a species that appears to be considerably inferior. Conversely, the species averaging lowest in a property will furnish some material better in that property than the average and much better than the poorer material of a species that is, in general, much superior. Consequently, too much importance should not be attached to relatively small differences shown by the data.

The practical importance of this table must necessarily be limited, as it must be remembered that these tests were based on clear wood and that only a very small percentage of such clear stock is found in Sweden. The tests seem to indicate that clear Swedish pine and spruce in most respects have mechanical properties only slightly inferior to those of the best American coniferous woods.

COMPARISON OF VARIOUS AMERICAN CONIFEROUS SPECIES WITH SWEDISH PINE AND SPRUCE. RESULTS OF TESTS ON SMALL CLEAR SPECIMENS.[a]

Species.[b]		Number of trees represented in tests.	Seasoning condition (see notes c and d.)	Weight per cubic foot.
Common names.	Botanical names.			
SWEDISH SPECIES.[c]				*Pounds.*
Pine	Pinus sylvestris	.....	Air dry	36
Spruce	Picea excelsa	.....	do	30
AMERICAN SPECIES.[d]				
Douglas fir	Pseudotsuga taxifolia	33	Green	38
			Air dry	34
Western hemlock	Tsuga heterophylla	15	Green	40
			Air dry	29
Western larch	Larix occidentalis	16	Green	46
			Air dry	56
Long-leaf pine	Pinus palustris	60	Green	48
			Air dry	42
Short-leaf pine	Pinus echinata	12	Green	50
			Air dry	38
Sugar pine	Pinus lambertiana	9	Green	51
			Air dry	26
Western white pine	Pinus monticola	44	Green	35
			Air dry	27
Western yellow pine	Pinus ponderosa	25	Green	46
			Air dry	26
White pine	Pinus strobus	40	Green	37
			Air dry	25
Red spruce	Picea rubens	51	Green	32
White spruce	Picea canadensis		Air dry	28
Sitka spruce	Picea sitchensis	17	Green	32
			Air dry	27

[a] Compiled by Forest Products Laboratory, Forest Service, U. S. Department of Agriculture, November, 1919.

[b] Nomenclature of the American species follows United States Forest Service Bulletin 17, Check List of the Forest Service Trees of the United States.

[c] From Untersuchung der Festigkeits-Eigenschaften Schwedischer Holzarten by Aug. Wijkander. Tests made on air-dry material at about 12.4 per cent moisture. Bending specimens approximately 4 by 4 by 64 inches (10 by 10 cm. by 1.6 m.) on 60-inch (1.5 m.) span. Compression-parallel-to-grain specimens 4 by 4 by 6 inches.

[d] From tests by United States Forest Service. "Green" means thoroughly green and unaffected by any drying. Value for "Air dry" obtained by adjusting to 12 per cent moisture results of tests made on material at 6 to 17 per cent moisture. Bending specimens 2 by 2 by 30 inches on 28-inch span. Others 2 by 2 inches by different lengths. Moisture per cents referred to in notes *c* and *d* are based on the oven-dry weight of the wood.

COMPARISON OF VARIOUS AMERICAN CONIFEROUS SPECIES WITH SWEDISH PINE AND SPRUCE. RESULTS OF TESTS ON SMALL CLEAR SPECIMENS—Continued.

Species—Common names.	Seasoning condition.	Shrinkage to oven-dry condition: Per cent of dimensions when green.			Static bending.			
		In volume.	Radial.	Tangential.	Fiber stress at elastic limit.	Modulus of rupture.	Modulus of elasticity.	Work to maximum load.
SWEDISH SPECIES.[a]					*Lbs. per sq. in.*	*Lbs. per sq. in.*	*1,000 lbs. per sq. in.*	*Inch lbs. per cu. in.*
Pine	Air dry					9,450	1,595	6.6
Spruce	do					8,600	1,510	5.8
AMERICAN SPECIES.[b]								
Douglas fir	Green	11.7	5.0	7.9	4,860	7,650	1,540	6.8
	Air dry				7,840	11,220	1,815	7.8
Western hemlock	Green	11.9	4.5	7.9	3,800	6,340	1,250	6.1
	Air dry				6,730	10,060	1,520	6.3
Western larch	Green	13.2	4.2	8.1	4,570	7,440	1,340	7.1
	Air dry				7,540	11,570	1,680	8.0
Long-leaf pine	Green	12.2	5.3	7.6	5,370	8,600	1,595	7.8
	Air dry				9,360	13,940	1,915	10.2
Short-leaf pine	Green	12.6	5.1	8.2	4,520	7,960	1,450	8.7
	Air dry				8,760	13,390	1,925	9.7
Sugar pine	Green	7.8	2.9	5.6	3,390	5,080	940	5.4
	Air dry				5,820	7,910	1,165	5.4
Western white pine	Green	11.3	4.1	7.4	3,370	5,220	1,170	5.0
	Air dry				6,020	8,660	1,450	6.8
Western yellow pine	Green	10.0	3.9	6.4	3,080	5,200	1,015	5.1
	Air dry				6,380	9,280	1,295	6.2
White pine	Green	8.8	2.2	5.9	3,320	4,930	960	5.2
	Air dry				5,680	7,990	1,225	5.8
Red and white spruce	Green	12.4	3.6	7.2	3,420	5,480	1,370	5.6
	Air dry				7,150	10,310	1,510	8.8
Sitka spruce	Green	11.1	4.3	7.2	3,320	5,480	1,225	6.2
	Air dry				6,210	9,210	1,440	8.3

Species—Common names.	Seasoning condition.	Impact bending.[c]	Maximum crushing strength in compression parallel to grain.	Fiber stress at elastic limit in compression perpendicular to grain.	Shear parallel to grain.	Hardness.[d]	
		Drop to cause complete failure.				End grain.	Side grain.
SWEDISH SPECIES.[a]		*Inches.*	*Pounds per sq. in.*	*Pounds per sq. in.*		*Pounds.*	*Pounds.*
Pine	Air dry		5,900		1,220		
Spruce	do		5,250		1,140		
AMERICAN SPECIES.[b]							
Douglas fir	Green	24	3,860	520	890	490	460
	Air dry	27	6,940	870	1,120	730	650
Western hemlock	Green	21	3,080	340	820	520	420
	Air dry	23	6,090	620	1,060	810	530
Western larch	Green	24	3,780	560	920	470	450
	Air dry	32	7,340	1,100	1,390	1,130	770
Long-leaf pine	Green	33	4,360	590	1,060	530	580
	Air dry	31	8,440	1,420	1,460	990	890
Short-leaf pine	Green		3,810	480	890	490	560
	Air dry		7,830	1,190	1,370	780	770
Sugar pine	Green	17	2,530	350	680	320	310
	Air dry	16	4,660	630	980	530	400
Western white pine	Green	17	2,540	280	620	300	300
	Air dry	21	5,100	560	840	460	400
Western yellow pine	Green	19	2,460	340	680	310	320
	Air dry	16	5,440	700	1,100	560	450
White pine	Green	17	2,440	260	650	310	290
	Air dry	18	4,750	550	890	450	370
Red and white spruce	Green	21	2,700	330	790	410	380
	Air dry	26	5,940	670	1,140	630	490
Sitka spruce	Green	25	2,580	320	770	420	340
	Air dry	25	5,040	660	1,150	710	460

[a] From Untersuchung der Festigkeits-Eigenschaften Schwedischer Holzarten by Aug. Wijkander. Tests made on air-dry material at about 12.4 per cent moisture. Bending specimens approximately 4 by 4 by 64 inches (10 by 10 cm. by 1.6 m.) on 60-inch (1.5 m.) span. Compression-parallel-to-grain specimens 4 by 4 by 6 inches.

[b] From tests by United States Forest Service. "Green" means thoroughly green and unaffected by any drying. Value for "Air dry" obtained by adjusting to 12 per cent moisture results of tests made on material at 6 to 17 per cent moisture. Bending specimens 2 by 2 by 30 inches on 28-inch span. Others 2 by 2 inches by different lengths. Moisture per cents referred to in notes [a] and [b] are based on the oven-dry weight of the wood.

[c] 50-pound hammer dropped from increasing heights, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, etc., inches until complete failure occurs.

[d] Load required to embed a 0.444-inch steel ball to one-half its diameter.

LARCH—HARDWOODS.

Larch (*Larix europa* and *Larix sibirica*) has been planted in small stands in Sweden and may attain some importance if planting is conducted on a big scale. It is especially adapted to shipbuilding material and has other desirable qualities. The present stands, however, are so small that they can not be given any consideration.

It is believed that none of the broad-leafed species in Sweden will attain any importance in the lumber-export trade, and they will not be treated in this report. Birch is the only hardwood of any consequence, and this species is only used locally in Sweden as a general-utility wood and also for fuel purposes. It is not cut into lumber for export. The lumber produced from the Swedish broad-leafed species is inferior in quality to the hardwoods imported from abroad.

STANDS OF TIMBER.

Although the Swedish authorities have investigated the forest resources of their country to a greater extent than has been the case in Finland and Norway, the data with regard to the stands and annual increment are not complete. Estimates of the stands have been made from time to time, but they are not supposed to be very reliable, and they vary from 37,100,000,000 cubic feet to 46,000,000,000 cubic feet.

A few years ago the Province of Vermland was made the subject of a very close investigation, with a view to ascertaining whether a similar investigation could be effected for the whole country. The Swedish Government now plans to carry out such an investigation sometime in the future, covering all Swedish forests, because the lack of definite information has hampered the forest experts in deciding what steps are necessary to operate the forests efficiently.

It may be of interest to give an abstract of the results of the investigation of the Province of Vermland. The area investigated was approximately 4,775,000 acres, in sections about 35 feet wide, with a distance of $1\frac{1}{2}$ to 3 miles between sections, extending diagonally through the Province. The total stand of timber in this Province was found to be about 3,400,000,000 cubic feet. Spruce constituted 48.43 per cent, pine 37.10 per cent, and other species, both coniferous and broad-leafed, 14.47 per cent.

The stands according to diameter at $25\frac{1}{2}$ inches from the ground were as follows:

	Per cent.
Trees having a diameter not exceeding $1\frac{6}{64}$ inches	3.95
Trees having a diameter of $1\frac{8}{64}$ to $3\frac{2}{64}$ inches	12.15
Trees having a diameter of $3\frac{6}{64}$ to $5\frac{5}{64}$ inches	23.40
Trees having a diameter of $5\frac{5}{64}$ to $7\frac{5}{64}$ inches	25.25
Trees having a diameter of $7\frac{5}{64}$ to $9\frac{5}{64}$ inches	17.95
Trees having a diameter of $9\frac{5}{64}$ to $11\frac{5}{64}$ inches	9.98
Trees having a diameter of $11\frac{5}{64}$ to $13\frac{5}{64}$ inches	4.36
Trees having a diameter of $13\frac{5}{64}$ to $15\frac{5}{64}$ inches	1.83
Trees having a diameter of $15\frac{4}{64}$ to $17\frac{4}{64}$ inches	.74
Trees having a diameter of $17\frac{4}{64}$ to $19\frac{4}{64}$ inches	.24
Trees having a diameter of $19\frac{4}{64}$ inches and up	.15
	100.00

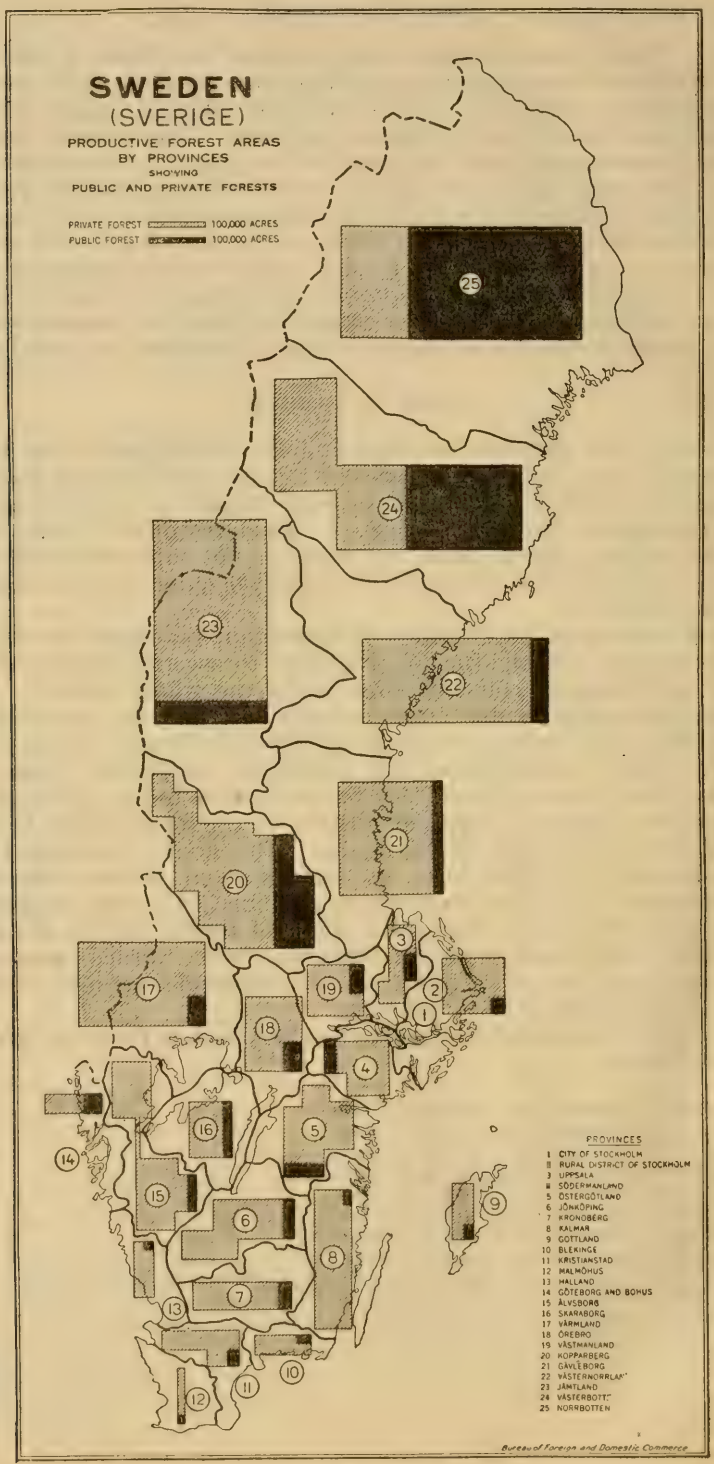

SWEDEN
(SVERIGE)
PRODUCTIVE FOREST AREAS
BY PROVINCES
SHOWING
PUBLIC AND PRIVATE FORESTS
PRIVATE FOREST 100,000 ACRES
PUBLIC FOREST 100,000 ACRES
PROVINCES
1 CITY OF STOCKHOLM
2 RURAL DISTRICT OF STOCKHOLM
3 UPPSALA
4 SÖDERMANLAND
5 ÖSTERGÖTLAND
6 JÖNKÖPING
7 KRONOBERG
8 KALMAR
9 GOTTLAND
10 BLEKINGE
11 KRISTIANSTAD
12 MALMÖHUS
13 HALLAND
14 GÖTEBORG AND BOHUS
15 ÄLVSBORG
16 SKARABORG
17 VÄRMLAND
18 ÖREBRO
19 VÄSTMANLAND
20 KOPPARBERG
21 GÄVLEBORG
22 VÄSTERNORRLAND
23 JÄMTLAND
24 VÄSTERBOTTEN
25 NORRBOTTEN
Bureau of Foreign and Domestic Commerce

FIG. 9.

The stands divided according to age showed the following results:

	Per cent.		Per cent.
Less than 20 years	4.56	100 to 119 years	5.88
20 to 39 years	23.83	120 years and up	7.05
40 to 59 years	29.18		
60 to 79 years	18.90		100.00
80 to 99 years	10.60		

The stands per acre of the productive forests for the whole Province were given as 2,771 cubic feet and the total increment as 32.9 cubic feet per acre. The committee effecting this investigation contended that if the forests in Vermland were more efficiently managed, they could easily yield 57 cubic feet per acre annually.

In the forests of Norrbotten and Vesterbotten, an investigation was made on an extensive property of forest lands of pine and spruce. The age of maturity for cutting was given as 140 years. These stands showed a large percentage of trees damaged by decay, even up to 11 per cent in some sections. The average stand per acre was given as 616 cubic feet and this figure may be considered fairly representative for these districts.

One of the best stands in Sweden is found in southern Norrland at Axmark, where there are 120-year-old stands of mixed pine and spruce. The average height of the pine is 90 feet and of spruce 69 feet. The stand per acre is given as approximately 11,200 cubic feet, but this is exceptional.

The best stand in Sweden is found in the forest of Jonaker, south of Stockholm. The stand consists of mixed pine and spruce and it is claimed that this mixed stand is the finest of its kind in Europe.

The Government has an experiment area in these forests, consisting of pine and spruce stands 150 years old, which shows 716 trees per acre and a stand of 21,180 cubic feet per acre. This area, however, is very small, but the statement is given here to show what stands may be obtained in Sweden. The average height of the trees in this forest is 97 feet, and the diameter 11½ inches at breast height.

An experiment area in central Norrbotten showed the following results:

Age of stand.	Average height.	Stand per acre.	Average annual increment.
	Feet.	*Cubic feet.*	*Cubic feet.*
40 years	19½	529	18.1
90 years	41½	1,814	27.0
150 years	52½	2,000	25.9

The following table gives an approximate estimate of the average annual increment and the stand per acre in the various sections of the country:

Districts.	Stand per acre.	Annual increment per acre.
North of 64° north latitude:	*Cubic feet.*	*Cubic feet.*
Coastal district	858 to 929.5	14.3 to 17.9
Interior district	429 to 715	7.2 to 10.7
62° to 64°	715 to 929.5	21.5
60° to 62°	786.5 to 1,144	28.6
South of 60°	858 to 1,287	28.6 to 42.9
Average Sweden	786.5 to 929.5	21.5 to 28.6

OWNERSHIP.

According to the statistics (1915) of the Swedish Forest Service, the forests of Sweden are divided as follows in regard to ownership: Public forests, partly owned by the State, 12,900,000 acres (23.3 per cent); privately owned forests, 42,400,000 acres (76.7 per cent); total productive forest land, 55,300,000 acres.[3]

The accompanying table shows the area in 1915 of public and private forest land, productive and unproductive, in the different Provinces of the country, according to the statistics of the Swedish Forest Service.

[3] The statistics published by the Swedish Forest Service in regard to the productive forest area and the figures given in the Swedish Statistical Yearbook do not agree.

AREA OF FOREST LANDS IN SWEDEN IN 1915 ACCORDING TO STATISTICS OF THE SWEDISH FOREST SERVICE.

Provinces.	Productive.					Unproductive (not including inland water).				
	Total.	Public.		Private.		Total.	Public.		Private.	
	Acres.	*Acres.*	*Per cent.*	*Acres.*	*Per cent.*	*Acres.*	*Acres.*	*Per cent.*	*Acres.*	*Per cent.*
Norrbotten	8,432,000	5,979,000	70.8	2,462,000	29.2	15,380,000	12,693,000	82.5	2,686,000	17.5
Vesterbotten	7,391,000	2,701,000	36.7	4,690,000	63.3	5,484,000	3,268,000	59.9	2,216,000	40.1
Vesternorrland	4,942,000	396,000	8.1	4,546,000	91.9	714,000	91,000	12.8	623,000	87.2
Jemtland	7,207,000	763,000	10.6	6,444,000	89.4	4,295,000	2,160,000	50.3	2,135,000	49.7
Gevleborg	3,668,000	326,000	8.9	3,342,000	91.1	393,000	90,000	22.9	303,000	77.1
Kopparberg	5,110,000	1,147,000	22.4	3,963,000	77.6	1,376,000	611,000	44.4	765,000	55.6
Vermland	3,353,000	145,000	4.3	3,208,000	95.7	360,000	28,000	7.7	332,000	92.3
Orebro	1,323,000	147,000	11.1	1,176,000	88.9	278,000	35,000	12.5	243,000	87.5
Vestmanland	894,000	119,000	13.3	775,000	86.7	260,000	30,000	11.5	230,000	88.5
Upsala	689,000	86,000	12.5	603,000	87.5	119,000	24,000	20.1	95,000	79.9
Stockholm	1,098,000	60,000	5.5	1,038,000	94.5	283,000	16,000	5.8	267,000	94.2
Sodermanland	994,000	103,000	10.4	891,000	89.6	80,000	36,000	45.4	44,000	54.6
Ostergotland	1,536,000	158,000	10.3	1,378,000	89.7	169,000	44,000	26.1	125,000	73.9
Gotland	375,000	38,000	10.2	337,000	89.8	176,000	6,000	3.3	170,000	96.7
Skaraborg	762,000	153,000	20.1	609,000	79.9	307,000	37,000	11.9	270,000	88.1
Elfsborg	1,822,000	98,000	5.4	1,724,000	94.6	383,000	35,000	9.0	348,000	91.0
Goteborg and Bohus	361,000	109,000	30.1	252,000	69.9	567,000	40,000	7.1	527,000	92.9
Jonkoping	1,486,000	127,000	8.6	1,359,000	91.4	556,000	26,000	4.7	530,000	95.3
Kronoberg	858,000	106,000	12.4	752,000	87.6	905,000	33,000	3.7	872,000	96.3
Kalmar	1,648,000	36,000	2.2	1,612,000	97.8	458,000	33,000	7.2	425,000	92.8
Blekinge	339,000	35,000	10.2	304,000	89.8	179,000	11,000	6.2	168,000	93.8
Halland	317,000	15,000	4.6	302,000	95.4	457,000	2,000	.5	455,000	99.5
Christianstad	639,000	49,000	7.6	590,000	92.4	192,000	11,000	5.6	181,000	94.4
Malmohus	131,000	16,000	12.3	115,000	87.7	135,000	1,000	1.0	134,000	99.0
Total, Sweden	55,345,000	[a] 12,903,000	23.3	42,442,000	76.7	33,506,000	[a] 19,361,000	57.8	14,144,000	42.2

[a] In this table has been included as public the area in northern Sweden not yet divided between the State and the farmers, aggregating 772,000 acres (1.4 per cent) of productive forests and 10,110,000 acres (30.2 per cent) of unproductive forests. The "public" forest lands are made up of (*a*) lands belonging to the Government and (*b*) lands belonging to the Church, to cities, counties, etc., and to official and semiofficial organizations.

PRIVATE FORESTS.

The private forests are in the hands of peasant landowners and other individuals, and large areas are owned by wood-using industries such as pulp and paper mills, sawmills, etc. It is estimated that one-third of the privately owned forest land in Sweden is in the hands of wood-using industries and about two-thirds is in the hands of farmers and other individual owners. In the districts of Norrland and Dalecarlia 37 to 38 per cent is owned by wood-using industries and 62 to 63 per cent by individuals. In southern Sweden the proportion of forest lands in the hands of the wood-using industries is somewhat smaller. Thus individual owners possess by far the largest areas of forest lands in Sweden.

In the Provinces of Norrbotten, Vesterbotten, part of the Province of Kopparberg, and the Islands of Gotland and Oland, the forests have been managed for years according to regulations laid down in special laws covering these territories, and the forests are fairly well conserved on this account. In the other sections of the country, particularly in southern Sweden and in the coastal districts, the forests have been cut for decades in excess of the annual growth. This refers mainly to the forests in the hands of smaller holders.

There are forests in Sweden belonging to large estates, which have been managed scientifically for more than a century, and these forests usually show excellent stands.

During the beginning and middle of the last century, the Government allotted forest lands to the settlers in northern Sweden, and this allotment was carried on until recent decades. Generally these farmers obtained larger forest areas than they required to provide for their own needs. Consequently, they have always had considerable timber for sale. Few of these farmers have taken any interest in the rational management of the forest lands; they have merely disposed of the timber in their forests to wood-using industries. It is only natural that these forests have been badly cut out in the districts where the laws have not prevented reckless cutting. The wood-using industries in northern Sweden possess large timber holdings, and these companies are now carefully managing the forests, although the great majority of them drained the forests to excess in the past.

Several sawmill companies in Sweden possess 1,000,000 to 1,500,000 acres of forest lands, which in many cases were acquired decades ago at very low prices. Many of these sawmills, which were among the pioneers in northern Sweden, received liberal support from the Government in the way of concessions permitting them to cut a certain number of trees in the State forests each year at a certain low price per tree. Many of these concessions were in effect up to 1918, but they expired in that year and were not renewed by the Government.

Besides possessing large areas of forest lands, these wood-using industries frequently own extensive farms and other agricultural properties also, which often were included in the forest lands purchased in the past. These conditions obtain in northern Sweden and closely resemble those prevailing in Finland. The same problem has come up in Sweden in regard to the danger of having the number of independent landowners decrease, and the Swedish Government took steps in 1906 to prevent the wood-using industries from pur-

Courtesy of State Forest Laboratory, Stockholm.

FIG. 10.—BIRCH FOREST, CENTRAL SWEDEN.

Courtesy of State Forest Laboratory, Stockholm.

FIG. 11.—HIGH STUMPS LEFT MORE THAN 50 YEARS AGO.

chasing land in the Provinces of Vesternorrland, Jemtland, Vesterbotten, and Norrbotten, and in portions of the Provinces of Gevleborg and Kopparberg.

There are, however, exceptions to these laws, and the wood-using industries may acquire land for the use of factories, yards, etc., and also forest lands that may not be deemed absolutely necessary for the use of the particular farm to which they belong. It has not been the intention of the Government, however, to prevent the wood-using industries from possessing a forest area adequate to safeguard the supply of raw material. In 1909 and 1912 strict laws were passed to the effect that the wood-using industries possessing agricultural properties must use them for agricultural purposes; also very strict laws were passed in regard to tenants. The law in regard to the compulsory cultivation of farm land in the hands of wood-using industries proved of inestimable value to the nation during the critical conditions of the war, when Sweden found itself able to produce a large percentage of the necessary food supplies. In northern Sweden the food conditions were much better during the war than in the south, because northern Sweden was able to produce adequate food supplies for its population, while the more densely populated districts in the south were not in so favorable a position.

Generally speaking, the Swedish sawmills have not such extensive areas of forest lands as those in Finland. They are therefore dependent to a greater extent upon the purchase of logs and timber from outside sources.

The private forests in Sweden have been severely drained in decades past, particularly in southern Sweden and the coastal regions. Not only has timber of large dimensions been cut, but saplings and immature growth have been recklessly exploited, especially by exporters of props. In many districts of Sweden dealers in props taking logging contracts for saplings and young stands are called "county shavers" because they have virtually shaved off most of the trees in the stands from the surface, leaving only scrubby growth. This practice has been stopped by the recent stringent laws.

The forests in the hands of the larger lumber and pulp companies have been severely cut at times, but these owners have generally given due consideration to reforestation problems, and the forests have been well managed. One company in the Province of Kopparberg, which is said to be the oldest stock company in the world, has carried on logging operations in its own forests since the company was started about 1225, and this company to-day probably has a larger quantity of standing timber than it ever had before, in spite of the fact that it has been logging for 700 years. Other companies in Sweden have not been in continuous operation so long, but the majority of the sawmill companies have carried out a rational forest policy for some time.

Previous to the war, considerable areas of forest lands were in the hands of foreigners, mainly Norwegians and English; but during the war the Swedes acquired a large percentage of these foreign-owned forests and practically speaking, the only foreign-owned forests in Sweden at the present time are limited areas in the hands

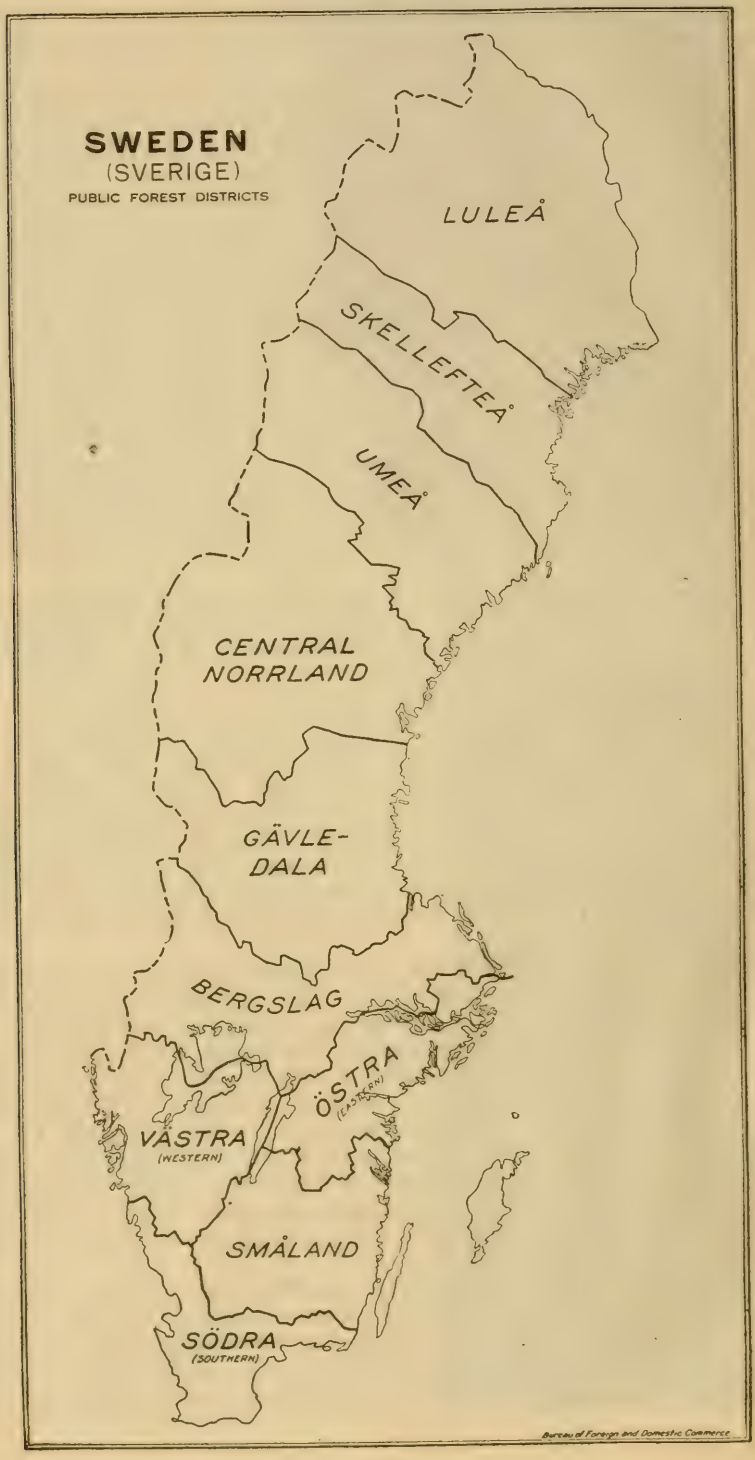

SWEDEN
(SVERIGE)
PUBLIC FOREST DISTRICTS
LULEÅ
SKELLEFTEÅ
UMEÅ
CENTRAL NORRLAND
GÄVLE-DALA
BERGSLAG
ÖSTRA (EASTERN)
VÄSTRA (WESTERN)
SMÅLAND
SÖDRA (SOUTHERN)
Bureau of Foreign and Domestic Commerce

FIG. 12.

of Norwegians. On the other hand, it may be noticed that Swedish concerns own forest lands in Norway. This foreign ownership in both countries may be explained from the fact that certain rivers originate in one country and flow into the other, and it is therefore logical that the wood-using industries located on these floating rivers should acquire the forest lands adjacent to these water systems, which only with difficulty could be exploited by industries situated in other districts. It may therefore be said that the forests in Sweden are owned almost entirely by Swedes.

PUBLIC FORESTS.[4]

In Sweden the State has possessed forests for more than 700 years, but these forests were, at that time, mainly the property of the King, and were used chiefly for hunting grounds. Later, in the sixteenth century, it was proclaimed that all lands not under cultivation, and not settled belonged to "God, the Swedish King, the Swedish Crown."

The State forests were, at first, located mainly in southern Sweden, because these districts were first settled, and forests were more valuable in that part of the country than in the sparsely settled districts of the north. It was not until the nineteenth century, when the sawmill industry started in central Norrland, that the State took any interest in proclaiming the ownership to the forests in this part of the country.

An intelligent exploitation policy in the State forests was not started until the beginning of the seventeenth century (1638), when the first rules were laid down in regard to forest management. At this time, the Swedish mining industry flourished and large quantities of wood were cut for charcoal to be used in smelting the ore. Concessions were given on very liberal terms to mining companies to log timber in the State forests for the production of charcoal.

At the beginning of the eighteenth century it was feared that the forest areas would be seriously decreased in the southern part of Sweden, and the Government started at this time energetically to reforest large areas of land close to the coast where the forests had been burned down and sand storms were prevalent. At the beginning of the nineteenth century a belief was prevalent in Europe that Government forest exploitation was necessarily inefficient. This belief took a strong hold in Sweden, and the Government sold large areas of forest lands to private individuals at extremely low prices. About the middle of the nineteenth century the Government gave liberal concessions to sawmills, as was mentioned in the preceding section.

It was not until about 1860 that the State realized the value of its forest domains. At this time the lumber-export trade was started on a large scale, with the consequent heavy increase in stumpage values. At that time the Government established the policy with regard to the management of its forests that it has since maintained. About 1875 the State took the first steps toward acquiring additional forest lands and since that time the area of the State forests has been increased, partly by purchases, partly by taking in other public forests, and partly by dividing large areas of forest lands in the

[4] Unless otherwise specified, the statistical information is based on the Official Statistics of the Swedish Forest Service for 1915.

northern part of the country between the State and the farmers. This last process even now is not complete. (See note to table below.) The area of State-owned forest land (including unproductive forests) was about 1,053,000 acres in 1870 and 14,984,000 acres in 1915.

On account of its unfortunate policy at the beginning of the last century the Government parted with valuable timberlands in southern Sweden and to-day by far the largest State-owned timberlands are situated in the extreme north of Sweden, and for the most part constitute the least desirable forest lands in the country. In southern Sweden the Government possesses many small and scattered timber areas. The administration of these properties is difficult and expensive, and their exploitation can not be so efficient as in the north, where the State-owned forests constitute large unbroken areas.

The public forest lands in Sweden may be divided into two categories: (*a*) Forest lands owned by the State, the income of which is enjoyed by the Government alone; and (*b*) ecclesiastical forests and forests belonging to cities, counties, communes, and official institutions, and to other official and semiofficial organizations. The State controls the cutting and to some extent the management of the forests in class (*b*).

The following table shows for 1915 the area of State forest lands and of other public forest lands (productive and unproductive) in Sweden:

Public forest lands.	Productive.	Unproductive.	Cultivated.	Total.
	Acres.	*Acres.*	*Acres.*	*Acres.*
State-owned	9,143,000	5,737,000	104,000	14,984,000
Other	2,988,000	3,514,000	.....	6,502,000
Total	12,131,000	9,251,000	104,000	[a]21,486,000

a This total does not include 772,000 acres of productive forest and 10,110,000 acres of unproductive forest in northern Sweden that is still undivided between the State and the farmers. It does include 104,000 acres of cultivated land in addition to the public forest lands considered in the table on page 39.

The area of productive forests that had been made subject to concessions for sawmill companies aggregated 104,000 acres in 1915. These concessions expired in 1918, and this area is now entirely under the control of the Government. The forest area that the Government set aside in times past for the support of the Swedish mining industry amounts to 62,000 acres of productive forest land. Extensive areas in the Province of Jemtland (408,000 acres of productive forest land) have also been set aside by the Government for reindeer pastures.

The ecclesiastical forests are scattered all over the country, with an area, in productive forest land, of approximately 677,000 acres. Many cities and towns in Sweden possess extensive areas of productive forests, which cover about 86,000 acres. For centuries a large number of counties and communes in Sweden have possessed productive forest lands (about 193,000 acres), which are operated for the benefit of the whole community. The remainder of the productive forests is in the hands of other official and semiofficial organizations, settlements, etc., and aggregates about 1,562,000 acres.

Of the total area of productive forests in Sweden, not including the undivided area, the public forests thus constitute 22.2 per cent. Of

the public forests, the State owns 69.7 per cent and the remainder, 30.3 per cent, constitutes other public forest lands.

The area of the public productive forests in each Province in 1915 is shown in the following table:

Provinces.	State-owned forests.	Other public forests.	Total public forests.	Provinces.	State-owned forests.	Other public forests.	Total public forests.
	Acres.	*Acres.*	*Acres.*		*Acres.*	*Acres.*	*Acres.*
Norrbotten	4,635,756	1,024,719	5,660,475	Kalmar	122,198	31,080	153,278
Vesterbotten	2,139,230	99,176	2,238,406	Kronoberg	60,560	37,639	98,199
Vesternorrland	333,010	63,375	396,385	Jonkoping	67,294	41,373	108,667
Jemtland	262,057	501,224	763,281	Skaraborg	87,611	39,621	127,232
Gevleborg	177,843	148,027	325,870	Elfsborg	67,360	38,813	106,173
Kopparberg	692,438	454,558	1,146,996	Goteborg and Bohus	25,582	10,363	35,945
Vermland	67,662	77,336	144,998	Halland	20,448	14,206	34,654
Orebro	101,199	45,586	146,785	Blekinge	7,465	7,146	14,611
Vestmanland	56,567	61,937	118,504	Christianstad	35,190	13,430	48,620
Upsala	15,792	70,326	86,118	Malmohus	10,746	5,374	16,120
Stockholm	23,838	36,314	60,152				
Sodermanland	29,457	73,513	102,970	Total, Sweden	9,143,017	2,988,190	[a] 12,131,207
Ostergotland	78,779	79,599	158,378				
Gotland	24,935	13,455	38,390				

[a] In this table is not included about 772,000 acres of productive forest land in northern Sweden, the ownership of which has not yet been decided.

The public forests are divided into 10 districts, and the productive forest area in each district is shown in the following table:

Districts.	State-owned forests.	Other public forests.	Total.	Districts.	State-owned forests.	Other public forests.	Total.
	Acres.	*Acres.*	*Acres.*		*Acres.*	*Acres.*	*Acres.*
Lulea	2,882,000	847,000	3,729,000	Vestra	164,000	76,000	240,000
Skelleftea	2,152,000	194,000	2,346,000	Smaland	208,000	107,000	315,000
Umea	1,751,000	94,000	1,845,000	Sodra	132,000	55,000	187,000
Central Norrland	572,000	554,000	1,126,000				
Gevle-Dala	917,000	603,000	1,520,000	Total, Sweden	9,143,000	2,988,000	12,131,000
Bergslag	209,000	266,000	475,000				
Ostra	156,000	192,000	348,000				

Administration.—The public forests in Sweden are managed by the Swedish Forest Service, which is a part of the Department of Agriculture and is located at the capital, Stockholm. At the head of the Forest Service are a General Director and six assistant directors. At the head of each district of the State forests are a district forester and a number of assistant foresters, forest engineers, and other assistants.

The Forest Service has complete control over the State-owned forests and either supervises or manages the other public forests. The Forest Service is also in charge of the execution of the laws in regard to the management of the forests in Sweden, cutting, etc., and it is also expected to work for improved methods of forestry in private, as well as public, forests. The increased profits during late years from the operations of the State-owned forests will enable the Forest Service to carry out many plans for improvements, such as draining, reforestation, etc.

The statistical information available in regard to public forest lands is restricted mainly to the State-owned forests, and these forests chiefly will be taken into consideration in this report.

The policy of the Swedish Government has been to endeavor to unite the many small parcels of forest land in the southern part of the

country by additional purchases of forest lands located in the intermediate sections. The Government has also purchased extensive areas of cut-over or burned forest lands with a view to reforestation of these areas. Purchases of this kind have been made notably in the coastal regions of southwestern Sweden. The Government generally buys cheaper forest lands than do private concerns, because the Government does not expect any immediate return, while private concerns must always take the financial side into consideration.

The Government purchases of forest lands were as follows from 1875 to 1915:

Years.	Acres.	Value.	Years.	Acres.	Value.
1875	5,000	$14,000	1901–1905	135,000	1,406,000
1876–1880	28,000	209,000	1906–1910	123,000	1,347,000
1881–1885	3,000	27,000	1911–1915	126,000	1,556,000
1886–1890	110,000	363,000			
1891–1895	116,000	679,000	1875–1915	978,000	7,715,000
1896–1900	332,000	2,114,000			

Stands.—Most of the virgin timberlands in Sweden are Government owned, and the Government has been very conservative in the cutting, particularly in the north, on account of the difficult conditions for logging and floating and the unsatisfactory market conditions for saw logs and wood products that are often present in that part of the country.

The information with regard to the stands in the State forests is very incomplete. An estimate made by the forest commissions gives the average stand in the State forests (productive forest lands) as follows, based on trees 4 inches in diameter and up, at breast height:

Districts.	Cubic feet per acre.	Districts.	Cubic feet per acre.
Lulea	458	Bergslag	901
Skelleftea	715	Ostra	1,030
Umea	858	Vestra	915
Central Norrland	1,001	Smaland	930
Gevle-Dafa	858	Sodra	787

In regard to the forests in portions of the two northernmost districts in Sweden, the following estimate is given—the result of a recent cruising in that section:

Items.		Norrbotten.		Vesterbotten.	
		Coast.	Interior.	Coast.	Interior.
Total area investigated	acres	241,661	15,209	26,607	840,843
Productive forests	do	177,389	13,519	22,543	652,008
Unproductive forests	do	63,936	1,675	3,978	186,643
Cultivated land	do	336	15	86	2,192
Young growing forest	cubic feet	25,619,000	2,348,000	2,528,000	128,160,000
	per cent	24	34	23	29
Stands mature for cutting	cubic feet	44,018,000	2,638,000	4,369,000	194,177,000
	per cent	40	38	40	43
Overmature and defective stands	cubic feet	39,561,000	1,982,000	3,946,000	127,095,000
	per cent	36	28	37	28
Total stands	cubic feet	109,198,000	6,968,000	10,843,000	449,432,000
	cubic feet per acre	615	515	481	689

A large area in the Provinces of Vesternorrland and Jemtland was also cruised over, and the results are shown in the following table, giving the actual percentages of barren land and of trees of different age groups, compared with the corresponding percentages for a normal stand based on cutting at 130 years:

Items.	Barren land.	1–20 years.	20–40 years.	40–60 years.	60–80 years.	80–100 years.	100–120 years.	120–140 years.	140–160 years.	160–180 years.
Actual percentages	4.0	3.0	9.7	13.2	9.7	5.5	4.9	9.9	12.7	27.4
Normal percentages based on cutting at 130 years	7.1	14.3	14.3	14.3	14.3	14.3	14.3	7.1	.....	.....

From this table it is seen that the State forests in the north contain a large percentage of overmature trees, and it is a great problem for the Forest Service to clean up these forests so as to give better growing conditions for the young stands. There is only a limited market for pulp wood in these northern sections of the country, and this is a great handicap in carrying out a rational forest policy. The coastal districts, on the other hand, offer better marketing facilities for small-dimension timber, which necessarily must be cut in order to improve the stands, and the forests are therefore largely second growth.

The forest commissions (see p. 58) have compiled statistics in regard to the percentage of trees 13¼ inches and more in diameter at breast height in the various districts of Norrland and Dalecarlia. This size is considered as mature timber for cutting saw logs, and the age varies from 140 to 200 years. The figures are as follows: Lulea, 25 per cent; Skelleftea, 22 per cent; Umea, 35 per cent; Central Norrland, 35 per cent; Gevle-Dala, 38 per cent; average, 34 per cent.

The average age of maturity in southern Norrland is from 130 to 140 years and in northern Norrland, from 160 to 180 years.

It has also been pointed out that on account of the large percentage of overmature stands, the timber shows serious defects, such as rot. The proportion of such defective timber is given at 3 to 20 per cent, according to location.

The latest report of the forest commissions also contains the following statement with regard to the percentages of trees of different age groups and of land denuded of forests in different parts of the State forests in southern and central Sweden:

Districts.	1–20 years.	21–40 years.	41–60 years.	61–80 years.	81–100 years.	101 years and up.	Land denuded of forests.
Bergslag	27.3	27.6	18.7	8.7	6.8	6.5	4.4
Ostra	20.6	25.2	18.7	13.8	8.3	4.5	8.9
Vestra	29.4	26.9	16.3	10.3	5.5	4.4	7.2
Smaland	23.7	21.5	18.6	10.7	6.6	11.4	7.5
Sodra	32.6	25.0	16.6	8.2	6.5	4.2	6.9
Average	26.7	25.4	17.9	10.3	6.7	6.3	6.7

Annual cut.—The State was extremely careful in cutting its forests up to the time of the war. The cutting system followed has generally been to fell only trees having more than a certain diameter at

breast height and the young growth has not been touched unless it was necessary to improve the stands.

In northern Sweden the State forests are often located in places where it is difficult to log the timber, and the floating facilities may also be unsatisfactory in many districts. These conditions are largely responsible for the unsatisfactory prices often obtained for Government timber. In some cases, however, there is no question that different purchasers of saw logs and standing timber have formed combinations or agreements with a view to holding down the price of the raw material, although this system is not developed to such an extent as in Finland.

The State may sell either the standing timber or the saw logs delivered at the banks of the floating rivers. The following statement shows how the total quantity of wood cut has been disposed of by the State during the years 1911–1915 (average): Standing timber sold, 78 per cent; logs cut by State and sold, 13 per cent; charcoal made from waste, 3 per cent; lumber sawed in Government mills, 1 per cent; wood cut for special purposes and not sold, 5 per cent.

The following detailed statement shows how the timber was disposed of in 1915:

	Cubic feet.
Standing timber sold	129,283,461
Wood cut before it was sold:	
Saw logs, pulp wood, props, railroad ties; etc	18,235,909
Saw logs cut into lumber in State-owned mills	1,273,624
Firewood, etc	10,484,735
Wood for charcoal (manufactured by State)	5,402,206
Timber cut for special purposes not for sale	5,585,201
Total	170,265,136

The following statement shows the cut per acre, from 1911 to 1915, of productive State forest land in the different districts of Sweden:

Districts.	1911	1912	1913	1914	1915
	Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
Lulea	5.9	5.1	7.0	7.2	9.6
Skelleftea	11.0	11.0	10.7	12.6	15.2
Umea	11.6	14.7	16.6	14.4	19.6
Central Norrland	25.0	22.0	30.0	29.9	35.2
Gevle-Dala	22.9	21.0	22.6	24.3	28.8
Bergslag	31.0	30.0	31.5	32.0	37.8
Ostra	25.3	27.5	28.7	29.0	32.2
Vestra	19.6	23.6	28.5	30.6	35.8
Smaland	23.5	24.6	24.6	25.9	32.9
Sodra	18.2	18.3	24.9	24.5	25.4
All districts	12.9	12.7	14.6	15.0	18.6

The following table shows the area of productive State forests, the cut, and the cut per acre, in each district of Sweden in 1915:

Districts.	Area.	Cut in 1915.	Cut per acre.	Districts.	Area.	Cut in 1915.	Cut. per acre.
	Acres.	*Cubic feet.*	*Cu. ft.*		*Acres.*	*Cubic feet.*	*Cu. ft.*
Lulea	2,882,000	27,553,000	9.6	Ostra	156,000	5,123,000	32.8
Skelleftea	2,152,000	32,800,000	15.2	Vestra	164,000	5,895,000	35.9
Umea	1,751,000	34,407,000	19.6	Smaland	208,000	6,731,000	32.4
Central Norrland	572,000	20,136,000	35.2	Sodra	132,000	3,407,000	25.8
Gevle-Dala	917,000	26,447,000	28.8				
Bergslag	209,000	7,766,000	37.2	Total, Sweden	9,143,000	170,265,000	18.6

The following statement shows the operations in the State forests for 1911 to 1915:

Years.	Standing timber sold.	Logs, firewood, etc., cut by State.	Timber cut for special purposes (not for sale).	Total cut.	Cut per acre.
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
1911	93,572,983	14,011,311	5,881,741	113,466,035	12.87
1912	93,085,853	16,052,852	8,428,899	117,567,604	12.73
1913	104,696,552	22,781,490	7,131,518	134,609,560	14.59
1914	104,390,466	27,835,674	5,938,403	138,164,543	15.02
1915	129,283,461	35,396,474	5,585,201	170,265,136	18.62

The following table shows the percentages of the total cut in the different districts for 1914 and 1915:

Districts.	1914	1915	Districts.	1914	1915
	Per cent.	*Per cent.*		*Per cent.*	*Per cent.*
Lulea	15	16	Bergslag	5	5
Skelleftea	20	19	Ostra	3	3
Umea	19	20	Vestra	4	3
Central Norrland	12	12	Smaland	4	4
Gevle-Dala	16	16	Sodra	2	2

About 17 per cent of the total cut is thus effected in the southern and central parts of the country and 83 per cent in Norrland and Dalecarlia.

The total cut of saw logs in the State forests in 1915, including those cut from the standing timber sold, was estimated at 53,000,000 cubic feet, or about 17 per cent of the total quantity of saw logs produced for sawing lumber for export in the country.

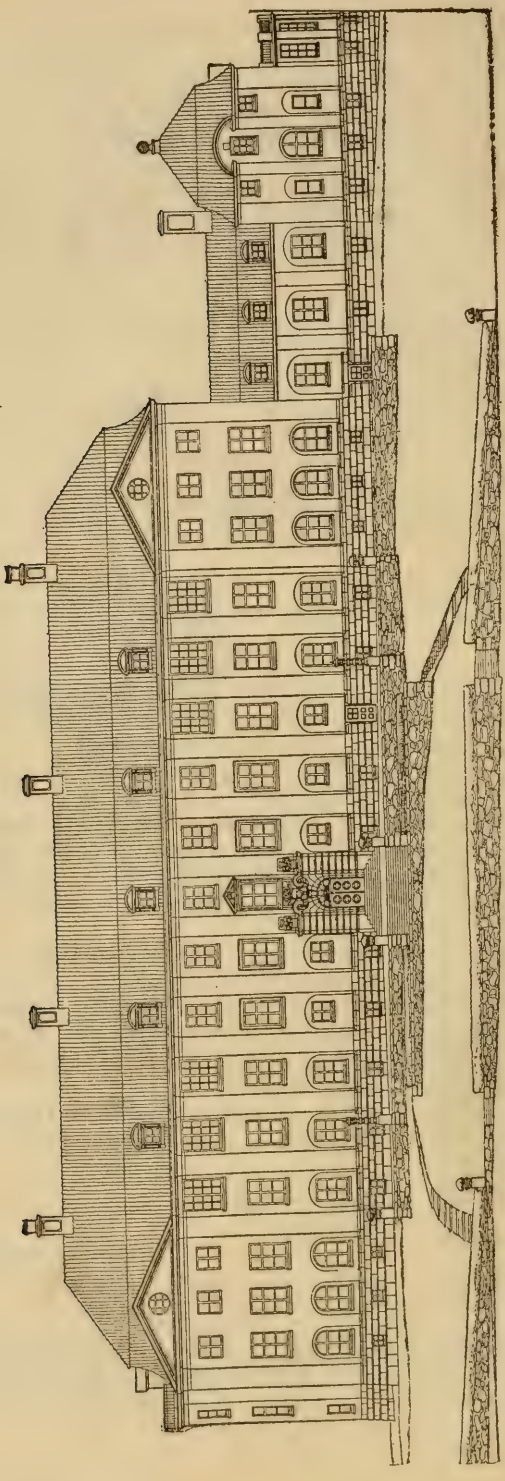
For the prices obtained for standing timber and saw logs from the State forests, see section "Logging."

Considerable quantities of charcoal are produced annually in the State forests. The figure for 1915 was approximately 3,500,000 bushels; for 1914, 3,100,000 bushels; and for 1911, 1,900,000 bushels. The increased production of charcoal was due to the high prices paid during the war.

Value and revenue.—The average value per acre of the State forests during the period 1911–1915 was as follows: Lulea, $4.66; Skelleftea, $9.97; Umea, $17.15; Central Norrland, $32.20; Gevle-Dala, $26.48; Bergslag, $36.58; Ostra, $27.47; Vestra, $34.51; Smaland, $37.65; Sodra, $25.73. The value of all State forests is approximately $135,608,000 (1915).

The following table shows the gross revenue from the State forests, the expenditures, the net revenue, and the net revenue per acre, from 1911 to 1915:

Years.	Gross revenue.				Expenditures.	Net revenue.	Net revenue per acre of productive forest.
	Sale of standing timber.	Sale of logs, etc.	Rents, etc.	Total.			
1911	$2,623,669	$603,148	$231,795	$3,458,612	$1,044,159	$2,414,453	$0.27
1912	2,794,541	741,578	236,243	3,772,362	1,159,676	2,612,686	.28
1913	3,609,684	1,097,801	232,972	4,940,457	1,415,206	3,525,251	.38
1914	3,241,588	1,459,337	256,822	4,957,747	1,686,512	3,271,235	.35
1915	4,899,987	1,999,449	271,801	7,171,237	1,857,968	5,313,269	.57



Courtesy of Swedish State College of Forestry.

FIG. 13.—Plan of Swedish State College of Forestry, Stockholm.

The table gives the latest available official figures, but it is understood that the revenue from the State forests has increased greatly since 1915.

Reforestation and improvements.—One of the Government's principal plans for reforestation in Sweden covers approximately 500,000 acres of heather, located largely in the Province of Halland. In this Province approximately 47,000 acres were reforested from 1890 to 1907, and approximately 25,000 acres from 1907 to 1917—a total of 72,000 acres in 27 years. Approximately 200,000 acres of heather in the whole country had been reforested up to 1917, and 300,000 acres remain to be reforested within the next 20 years, according to the plan.

Considerable areas have been planted and seeded in the State forests; in 1915, 2,965 acres were planted and 8,649 acres seeded at a cost of $80,400. The cost of this forest culture in the State forests averaged $6.16 per acre from 1911 to 1915, including plants, seeds, etc. It has been conducted especially in southern Sweden. The forests in northern Sweden appear to have been given less attention by the Government in this respect, although they have yielded by far the largest revenues.

The Government has furthermore accomplished considerable work in road building, the cleaning up of rivers for floating purposes, drainage, etc.

FOREST INSTITUTIONS AND SCHOOLS.

Since 1902 the Government has operated a forest laboratory devoting its time to research and investigations on questions bearing on forestry. The laboratory has two sections, one devoted to forest management and investigations in regard to the growth of the stands, etc., and the other devoted mainly to geological and botanical studies.

This laboratory maintains experiment areas in all parts of the country and has already accomplished excellent results. It publishes numerous books and reports with a wide circulation among Swedish forest owners, who follow with interest the results of these investigations. It is felt that the work of the laboratory is of the greatest practical importance because the Government is in a better position than individual forest owners to determine by experiment how to obtain the most satisfactory results from forest exploitation.

The laboratory has also experimented extensively with the planting of foreign species in Sweden.

Sweden has had a college of forestry since 1828. In 1915 the old institution was found inadequate for the needs of the country and a new college, with magnificent buildings and equipment, took its place. The college is located in the outskirts of Stockholm, in the vicinity of many similar institutes.

The requirements for entrance to the College of Forestry are nine months of practical training in the field and a solid foundation of higher education (college graduation). The course covers both theoretical and practical instruction and lasts during three autumn, two spring, and two summer terms. Another shorter course of 1½ years is maintained, for which the entrance requirements are 22 months of practical experience in the field and a high-school education. A variety of subjects are taken up, such as chemistry, zoology, botany,

forest management, cruising, etc. The graduates from the first course qualify for service in the State forests as district foresters and those from the second course as foresters in minor capacities.

It has often been difficult for the Government to turn out a sufficient number of graduates to supply the demand for foresters in Sweden, as many graduates of the College of Forestry enter private service. The college is without an equal in northern Europe and upon the work of its graduates will largely depend the future of the rational management of the Swedish forests.

Singularly enough, slight attention has been paid to the testing of timbers in Sweden, and no adequate machines are found at the State college for making such tests. The only institute in Sweden that has conducted any research work along this line is the Chalmerska Institute in Goteborg.

The State also maintains seven schools of forestry in different parts of the country. At each school there is an experiment forest area devoted to practical instruction for the students. The course generally lasts one year, and the object is to give practical insight into forest management and the supervision of operations in the forests. Both the Government and private institutes maintain special courses of instruction in burning charcoal.

The instruction in all State-owned colleges and schools is practically free, and at the forest schools the students also obtain their board and rooms free of charge.

There are a few private schools and institutes for the teaching of forestry generally connected with agricultural colleges.

The Ericson Institute of forest management and sawmilling in Hernosand is unique in northern Europe. This institution is devoted to the teaching of subjects such as logging and milling, and special stress is laid upon methods of crosscutting, grading, and sawing the logs so as to obtain the best possible results. All the operations in sawmill, yard, and dock are also studied. This school is attended by forest and sawmill operators from all over northern Europe.

Formerly Swedish foresters were to a great extent dependent upon Germany for their education in the advanced subjects of forestry; but, with the present system of schools and institutes, Sweden is in a position to give satisfactory instruction in all phases of the subject.

FOREST FIRES.

Most of the forests in Sweden give evidence of having been burned over in centuries past and most of what has not been burned over has been logged over. There are only small areas of virgin timberlands untouched by fire or ax. Forest fires in Sweden are not important at present; the damage in any one year would not exceed $250,000. This is due to the efforts of the private forest owners, as well as the Government, to check forest fires.

Concerning the fires in private forests, the information obtainable is very meager. It is estimated that the burned area in the public forests (State-owned and other) may average from 10,000 to 12,000 acres annually and in private forests from 30,000 to 40,000 acres.

Courtesy of State Forest Laboratory, Stockholm.

FIG. 14.—SIXTEEN-YEAR-OLD PINE STAND IN CENTRAL NORRLAND.

Courtesy of State Forest Laboratory, Stockholm.

FIG. 15.—DRAINING OF FOREST LAND, SOUTHERN NORRLAND.

Courtesy of Forester O. Eneroth.

FIG. 16.—METHOD OF CUTTING. TREES MARKED "X" ARE TO BE REMOVED TO GIVE BETTER GROWING CONDITIONS FOR REMAINING TREES.

The following figures show the burned areas in the State-owned forests from 1876 to 1912:

	Acres.		Acres.
1876–1879	93,000	1900–1904	47,000
1880–1884	60,000	1905–1909	4,000
1885–1889	51,000	1910	1,000
1890–1894	37,000	1911	2,000
1895–1899	9,000	1912	2,000

There are no important forest-fire insurance companies in Sweden, although such companies have been planned on various occasions.

In many forests there are efficient fire-patrol systems, but in the northern districts of the country it is difficult to patrol the forests, because the population is very scattered. The absence of underbrush, the scattered stands, and the precipitation throughout the year cause the damage done by forest fires in Sweden to be very limited, and this question does not merit a great deal of attention.

TAXES.

Before the war the taxes in Sweden were very moderate. There was no important tax on standing timber, but taxes, municipal or Government, were levied on the profits derived from the sale of the forest products cut each year. The taxes seldom exceeded 12 to 14 per cent of the income, and in many cases they amounted to less than this figure.

Besides a special tax of 1.3 per cent for the support of the forest commissions there was another special tax of 2 per cent which was collected by the communes where the forests were located.

During the war the taxes increased very materially, and in many cases as much as from 40 to 45 per cent was paid on large incomes. There is still, however, no important tax on standing timber, as it is felt that such a tax might lead to cutting that would not be in accordance with rational management.

VALUE OF TIMBERLANDS.

The total value of the Swedish forests was last estimated in 1908, when the national wealth of Sweden was estimated at about $3,800,000,000. The following valuation was made for the forests at that time: State forests, $62,000,000; other public forests, $21,000,000; private forests, $334,000,000; total, $417,000,000.

Since 1908 all values have gone up, and these figures are of little importance at the present time. It may be of interest, however, to see what values were placed on the timberlands of the Government in proportion to the values of other public forests and of private forests. The table following shows the valuation per acre in 1908 of Government forests, other public forests, private forests, and all forests in the different Provinces of Sweden and in the whole country.

Provinces.	Government forests.	Other public forests.	Private forests.	All forests.	Provinces.	Government forests.	Other public forests.	Private forests.	All forests.
	Per acre.	*Per acre.*	*Per acre.*	*Per acre.*		*Per acre.*	*Per acre.*	*Per acre.*	*Per acre.*
Stockholm	$10.85	$14.20	$9.70	$9.85	Elfsborg	$11.95	$13.15	$7.75	$8.00
Upsala	16.30	16.30	13.00	13.40	Skaraborg	21.15	16.90	10.45	11.95
Sodermanland	15.25	17.45	10.70	11.20	Vermland	16.30	19.55	10.45	10.85
Ostergotland	19.00	19.00	11.40	12.20	Orebro	17.40	20.90	13.00	13.40
Jonkoping	21.15	17.95	8.50	9.35	Vestmanland	17.40	20.90	13.00	13.75
Kronoberg	18.45	15.70	7.40	8.85	Kopparberg	9.20	7.80	7.80	8.00
Kalmar	19.55	16.60	7.80	8.80	Gevleborg	25.45	13.95	8.85	9.85
Gotland	7.10	7.80	5.65	5.85	Vesternorrland	11.95	9.50	7.14	7.50
Blekinge	8.70	9.50	7.80	7.80	Jemtland	12.45	12.45	6.85	7.10
Christianstad	7.65	8.30	7.65	7.65	Vesterbotten	7.10	6.40	5.65	6.10
Malmohus	21.15	12.70	15.80	16.05	Norrbotten	3.20	3.90	3.20	3.20
Halland	8.20	8.20	6.45	6.80					
Goteborg and Bohus	4.35	5.20	4.85	4.85	Total, Sweden	6.70	10.30	8.00	7.90

In 1918, the value of average forest land (2,100 to 2,500 cubic feet per acre) was generally given as $32 to $54 per acre, according to the location and quality of the timber. For better stands as high as $108 per acre was frequently paid. These values, however, may be considered as maximum.

Frequently, extensive forest holdings are purchased, including farm land and other cultivated property. In such cases the value is based on the cubical contents of the stands and may range from 4 to 6 cents per cubic foot of standing timber. Before the war, about half of these prices was paid. It is difficult to give the present value of the timberlands, because there are many conditions to be considered in each case, such as the distance from the forests to the nearest floating rivers, which is of special importance in forest operations. Generally speaking, however, the value of timberland increased at least 100 per cent from 1913 to 1918.

Before the war, it may be said that the value of timberlands of average good stands was about $5.35 per acre in the northern Provinces of Sweden, $15.50 per acre in central and southern Norrland, and $12.90 per acre in southern Sweden.

LAWS AFFECTING FOREST MANAGEMENT AND CUTTING.

The first laws with regard to forest management and cutting considered only the forest lands in public ownership and date 700 years back. Later, however, the private forests were considered, and to-day every acre of forest land in Sweden is subject to special regulations adapted to suit the circumstances in each part of the country.

As the question of laws governing forest management and cutting is under consideration at the present time in the United States, it may be of interest to give the essential points of the Swedish forest laws, because the conditions in Sweden are to a great extent similar to those prevailing in most of the forest sections in this country. It must be borne in mind that a great majority of the Swedish forests extend through an area with a very scattered population, and that these forests can not be managed in the same way as the forests in central Europe where the population is much more dense.

The different sections of the country to which the following laws apply are designated on Fig. 17.

SWEDEN
(SVERIGE)
FOREST AREAS
COVERED BY SPECIAL
LAWS
General Law for Private Forest
Lappmark Law
Dimension Law
Protection Forest Law
Gottland and Öland Law
Bureau of Foreign and Domestic Commerce.

FIG. 17.

LAPPMARK LAW.

The Lappmark law, which was passed in 1866 and 1873, applies to the private forests in the interior Provinces of Norrbotten and Vesterbotten and stipulates that cutting must be effected only after the trees have been marked for cutting by a Government forester. The cutting system is based on principles suitable for these particular districts, where the growth of the timber is very slow. The marking of trees is made for three years in advance. In this way it is endeavored to safeguard the future of these forests and also to obtain the highest possible annual yield. The owners of these forests may cut the wood necessary for their personal use or for use on their property, such as building material, fuel, etc. The compulsory marking of trees by a Government forester refers only to trees destined for commercial purposes. The law is intended to protect the cultivated areas in northern Sweden by preventing the forests from being cut down, because the forests shield the agricultural land. It was also considered important that lumber and pulp mills should be prevented from purchasing farm wood lots the loss of which would greatly reduce the farm's value because they represent its sole source of building materials and fuel.

The effect of the law has been the conservation of the forests, but it can not be said that the forest management has been satisfactory in all respects. The cutting has been regulated according to the principle of annual growth, and as these forests often contain up to 90 per cent of overmature stands, showing a very small annual increment, the cutting has been very restricted. It has been contended that it would have been better policy if these overmature forests had been cut to a greater extent, because they represent dead capital. Cutting out these overmature stands, it is believed, would also afford better growing conditions to the younger stands.

An amendment to this law in 1915 provided that overmature forests might be cut to a larger extent, if the forest owner took the necessary steps for reforestation.

DIMENSION LAW.

The dimension law, passed in 1874 and 1882, applies to the coastal districts of the Provinces of Norrland and Vesterbotten. It was intended to check the excess cutting of young stands. The law stipulates that no timber less than 7 inches in diameter at 16 feet from the ground may be cut unless special permission is given by a Government forester. An exception to this rule is granted when timber is cut for the owner's personal use. Before this law was passed, large stands of young forests were recklessly cut down for small timber for export.

This law is of a decidedly primitive character and has not improved forest management. The stands have been drained of large-dimension timber, while old and defective small growth has been left. An improvement in this law is expected.

SPECIAL FOREST LAW FOR GOTLAND AND OLAND.

A law was passed in 1869 to protect the forests on the Islands of Gotland and Oland, in the Baltic Sea. The law states that land suitable for forests shall be maintained as forest land, unless the stands are cut down with a view to utilizing the land for agricultural

purposes. Cutting for other purposes than for the personal needs of the forest owner and his property must be reported in advance to the authorities, who grant licenses for cutting. After the cutting has taken place, the owner must take the necessary steps for reforesting the cut-over areas.

The forest areas in the Islands of Gotland and Oland had been severely drained before this law was passed. The operation of the law has been very satisfactory, particularly as it is enforced by special forest commissions. (Regarding forest commissions see following chapter.)

FOREST LAW FOR OTHER PARTS OF SWEDEN.

The law governing the management of private forests in other parts of Sweden was passed in 1903. The substance of this law is that forest lands in private ownership must not be cut in such a way that the reproduction of the forests would be endangered. If the forests are cut recklessly the owner must take steps to have his lands reforested. Enforcement and supervision of the law are left to the forest commission in each Province.

This law was passed with a view to checking the excess cutting that had taken place in Sweden prior to 1903 and to safeguard the nation's timber supply. The effect of the law has been generally satisfactory. But the regulations have not been strict enough in all cases to protect the forests, especially those exposed to the elements. Furthermore, it has been contended that this law does not protect standing forests, but merely makes provision for reforestation.

During the war the greatly increased excess cutting resulted in an amendment of this law. The new law passed in June, 1918, stipulates that young growing forests in the territory to which this law applies must not be cut unless such cutting is effected with a view to improving the stands (thinning). Dispensation may be given by the forest commission in each Province if it is found that the cutting of young growth is in accordance with the principles of rational forest management. If the cut-over land is destined for agricultural purposes, pastures, building sites, etc., this law does not apply. This law is expected definitely to safeguard the nation's timber supply.

If the law is broken, the forest commission shall prohibit any future cutting of the young growth beyond the quantities that the owner may need for his personal use or for use on his property. The owner of a forest where the commission has prohibited further cutting may appeal to higher authorities in case of complaint regarding the forest commission's decision. If the forests are cut in spite of the commission's regulations, a fine is imposed upon the forest owner and the timber cut is confiscated.

LAWS CONCERNING PROTECTION FORESTS.

In several parts of Sweden it has been found that the forests must be conserved in order to shield adjacent agricultural land and to protect lands close to the sea from sand storms. These protection areas are located mainly in the Province of Jemtland and on the southwestern coast of Sweden. The forests in these territories must not be cut for other purposes than the personal needs of the owner and

his property unless the trees are marked by a State forester. The law does not contain any regulations for forest management.

The improved floating conditions of many Swedish rivers in the mountainous regions had made it possible for the Swedish lumbermen to extend the area of logging operations toward the mountains after having exploited the other districts. The consequence was that previous to the passage of this law the forests were injudiciously cut at the timber limit, so that new growth was impossible and the timber limit was lowered each year.

The protection forests are under the direct supervision of the Government and the activities of the forest commissions do not extend to them. Many people believe it would be advantageous to have the forest commissions supervise the cutting of these forests also.

AREAS COVERED BY FOREST LAWS.

According to the forest-service statistics for 1915, the areas where these laws are in force are as follows, including about 554,000 acres of private forests over which the State has a certain amount of control:

	Acres.
Area covered by Lappmark law	4,755,000
Area covered by dimension law	3,180,000
Area covered by protection-forest law	2,074,000
Area covered by Gotland and Oland law	335,000
Area covered by laws concerning private forests in other sections	32,636,000
Total	42,980,000

FOREST COMMISSIONS.

Since 1903, each Province where the general law governing the cutting in private forests is in effect has had a forest commission, consisting of three members serving for a term of three years—a chairman appointed by the Government, one member appointed by the provincial government, and one member appointed by a local association of a semiofficial nature working for the betterment of agriculture and forestry in each Province. There is no central organization of forest commissions; each commission reports to the forest service. Their reports are published by the Swedish Forestry Association, the work of which is described in the next section. The commissions are often assisted by expert foresters and they also have local committees, when necessary, in the communes and counties.

Besides seeing that the law is properly carried out, the forest commissions perform an important function in furthering local interest in better forest management. Their program includes the maintenance of nurseries and the distribution of seeds and plants for reforestation purposes. Furthermore, these commissions issue many treatises on forest culture, conservation, forest management, etc. In 1914 about 50,000 acres of land was placed under forest culture, under the supervision of the forest commissions.

The expenses of the commissions are defrayed partly by a special tax amounting to 1.3 per cent of the stumpage values of the timber cut. Ninety per cent of the amount collected in this way is used in the Province in which it is collected and 10 per cent goes to make

up a central fund for the whole country. The law stipulates that the funds collected from this tax must be used for no purposes other than the forest commissions' work and other expenses connected with the management of private forests. Besides this special revenue, the forest commissions obtain considerable support from both the Provinces and the Government. In 1915 the subsidy received from the Government was $45,000 and from the Provinces $34,000. A profit of $55,000 was derived from the sale of plants, seeds, etc. The income from special taxes was $310,000, making a total income of $444,000.

Only where forest owners are unwilling to comply with the directions of the forest commissions are the cases taken to court. The work of the commissions has been quite satisfactory, and very little trouble is experienced in enforcing the law. It is believed that the forest commissions have encountered less opposition than would have been met by any purely governmental agency. The control of the cutting in privately owned forests is a decided limitation on private-property rights, which is less of a burden and is more likely to be recognized as an ultimate benefit, it is thought, when exercised through a commission on which local interests, both public and private, are represented.

The new forest law of Finland provides for forest commissions after the Swedish pattern.

FORESTRY ASSOCIATIONS.

Associations interested in promoting forestry are very active in Sweden. The most important is the Swedish Forestry Association, founded in 1902, which issues numerous publications on forest management, forestry, and related subjects and has had a very beneficial influence in spreading information among people interested in forestry. A very practical step has been taken by this association in dividing the publications into two categories, one consisting of popular monographs on forest problems, intended for reading by the general public, and the other of more scientific material. This association publishes the reports of the forest commissions.

Another organization of great importance is the Association of Forestry in Norrland, which also issues many publications. In southern Sweden there are several smaller associations working for better forest management, etc.

In the Provinces where the forest commissions do not operate, the provincial governments and agricultural associations have appointed special experts, who work for the furthering of rational forest management practically without remuneration.

Every year, during the early spring, the Swedish Association of Forestry arranges for a forest week, which is attended by all the industries and individuals interested in forestry. Great importance is attached to this convention, which is attended by the leading men of the country and is opened by the Swedish King. By attending these conventions, one receives a very striking impression of the consideration given to the forests in Sweden and the dependence of the nation upon its forest wealth.

ANNUAL INCREMENT AND ANNUAL CONSUMPTION.

The statement that the Swedish forests are cut in excess of their annual growth has been made for hundreds of years. These conclusions seem very peculiar to-day if one does not take into consideration that the accessible forest area has been extended largely during the past generations and even to-day there are extensive timber holdings in northern Sweden that have not been opened up to exploitation on a large scale.

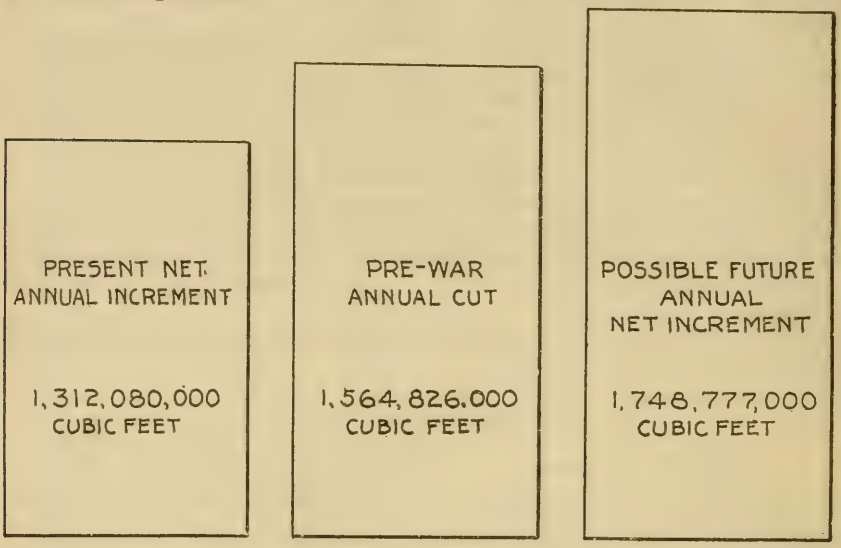


FIG. 18.—Annual increment and annual cut in the Swedish forests and possible annual increment.

In centuries past, only the forest areas in the immediate proximity of the more densely populated districts were exploited because the floating rivers were not improved so as to facilitate the transportation of saw logs.

The first statement in regard to annual increment and annual cutting was published in a report of the forest commissions in 1855, giving the annual cutting as 660,604,000 cubic feet and annual growth at 528,441,000 cubic feet. It was estimated at that time that an excess cutting of 132,163,000 cubic feet took place annually. Since that time, the accessible forest areas have been materially increased by improved methods of floating. Various estimates have been made during the last 20 years and nearly all concluded that considerable excess cutting has taken place. If this excess cutting had taken place however to such an extent as has been stated, there would probably be very little left of the forests of Sweden. Such extreme estimates must therefore be considered erroneous.

The latest estimate of the annual increment was published in 1919, from figures of the forest commissions. The following table shows for the different districts of Sweden, the productive forest area (public and private forests), the annual increment per acre, the total annual

increment, the allowance made for waste (top logs, stumps, etc.), the net annual increment, and the net annual increment per acre:

Provinces.	Productive forest area.	Total annual increment.		Deduction for waste.	Net annual increment.	
	Acres.	*Cubic feet per acre.*	*Cubic feet.*	*Per cent.*	*Cubic feet.*	*Cubic feet per acre.*
Norrbotten and Vesterbotten:						
Interior districts (two-fifths of total area)	6,328,000	11.4	72,336,000	25	181,404,000	8.6
Lower districts (three-fifths of total area)	9,495,000	17.9	169,537,000			13.4
Jemtland, Vesternorrland, Gevleborg, and Kopparberg	20,898,000	28.6	597,077,000	15	507,516,000	24.3
Forest area south of above Provinces, except Provinces of Skane, Halland, and Blekinge	17,199,000	35.7	614,252,000	8	565,112,000	32.9
Skane, Halland, and Blekinge	1,425,000	42.8	61,103,000	5	58,048,000	40.7
Total, Sweden	55,345,000	27.3	1,514,305,000	13	1,312,080,000	23.7

The "deduction for waste" allows for a waste of 202,225,000 cubic feet, which, it is believed, will be utilized to a great extent in the future when better transportation facilities and increased markets may be expected.

The report of the forest commissions also makes an estimate, published in 1919 but based on pre-war conditions, in regard to the consumption of wood in Sweden and the quantities exported, as follows:

	Cubic feet per inhabitant.
I. Domestic consumption (farms, household, etc.):	
Norrbotten and Vesterbotten	183.6
Jemtland, Vesternorrland, Gevleberg, and Kopparberg	171.2
South of above Provinces, except Skane, Halland, and Blekinge	132.4
Skane, Halland, and Blekinge	61.8
Average, Sweden	128.8
	Cubic feet.
Total domestic consumption	732,710,000
II. Exports of wood	303,185,000
Logs, round and hewn timber (including loss of sunken logs, etc., 15 per cent)	54,598,000
Sawn lumber (including sunken logs, shrinkage when drying, sawmill waste, etc., 25 per cent)	210,869,000
Semimanufactured (including sunken logs, shrinkage when drying, sawmill waste, etc., 30 per cent)	37,718,000
III. Wood used for pulp manufacture and firewood used in manufacture of pulp	323,245,000
IV. Wood used by mines, in smelting ore, and for charcoal for export	198,630,000
V. Wood used for manufacture of wood tar for export	7,056,000
Total consumption	1,564,826,000

According to the foregoing estimates covering the annual increment and annual consumption, there was an excess cutting in Sweden immediately before the war of not less than 252,746,000 cubic feet.

The forest commissions' report also estimates what the Swedish forests could yield if they were more rationally managed. The estimate, which follows, may be considered as the maximum yield in the future.

Provinces.	Annual increment per acre.	Total annual increment.
Norrbotten and Vesterbotten:	*Cubic ft.*	*Cubic ft.*
Interior districts	14.3	90,420,000
Lower districts	25.0	237,352,000
Jemtland, Vesternorrland, Gevleborg, and Kopparberg	35.7	746,346,000
Forest area south of the above Provinces except Skane, Halland, and Blekinge	50.0	859,953,000
Skane, Halland, and Blekinge	57.2	81,471,000
Total, Sweden	36.4	2,015,542,000
Reduction for waste		266,765,000
Net annual increment		1,748,777,000

Thus, the Swedish forests could produce 436,697,000 cubic feet in excess of their present production. Applying the foregoing estimate to the pre-war conditions, the Swedish forests would yield 183,953,000 cubic feet in excess of the annual cut.

During the war, it has been estimated that the cut in the Swedish forests has exceeded the pre-war cutting and may be estimated at 1,765,000,000 to 2,118,000,000 cubic feet annually.

The estimates of the present annual increment may not give the correct idea of the conditions of Sweden, as large areas of overmature forest lands are found in the northern part of the country, where the annual growth is very small. When these overmature forests are cleaned up, better growing conditions will be given to the remaining stands and this may have a very important effect upon the future yield of the Swedish forests.

It is evident that the consumption of wood in Sweden for domestic purposes, such as households, farms, fuel, etc. must necessarily be greatly curtailed and substitutes for wood will be used more extensively that at the present time. In this way the wood may be used for such purposes as pulp and lumber and will yield a better profit than if it were used for fuel.

The previously mentioned plans of draining swamp lands must also be taken into consideration. Large quantities of timber will be produced in these areas when they are reforested.

With a better understanding of rational forestry and the strict enforcement of the new laws, the future supply of wood in Sweden will be amply safeguarded and the annual increment of the Swedish forests will probably be materially increased.

LOGGING.

Owing to the fact that Norrland and Dalecarlia, under normal conditions, produce more than 75 per cent of the lumber for export and also because forest operations there are on a large scale, these regions will be given particular attention in this chapter. Nearly all the operations in southern Sweden are on a small scale and are often inefficient, offering very little interest for a study of standard forest operations in Sweden.

METHODS OF OBTAINING RAW MATERIAL FOR SAWMILLS.

The larger export sawmills generally have extensive areas of forest land but very few mills base their production of lumber on raw

material from their own forest alone. The great majority of the mills acquire saw logs from other sources, either from public forests or from private forest owners. These purchases are not limited to Sweden alone; timber is taken from Finland also in large quantities and to some extent from Norway, in cases where the floating rivers originate in the forest regions of Norway.

Swedish sawmills own extensive areas of timber land in both Norway and Finland, but most of the logs taken from these two countries are purchased from Finnish and Norwegian forest owners, respectively. In Sweden either the mills may make contracts with the forest owners for a certain quantity of timber marked for cutting or they may bid for standing timber in the public forests.

Many forest owners, and to some extent the State, sell large quantities of cut saw logs delivered on the banks of the various waterways in Sweden. There are no reliable statistics showing to what extent the Swedish sawmills are dependent on purchased logs, but it may be estimated roughly that 30 to 40 per cent of the logs used by the export mills are taken from their own forests and the remainder are purchased or cut on other forest lands than their own.

Years ago the mills sawed only pine, as spruce was considered of little or no value and was left in the forests. In some cases, logging contracts specified that the party taking these contracts could cut spruce at a very small compensation and in many cases no charge was made for spruce timber. About 50 years ago the logging contracts in Norrland generally specified that the cutting was limited to pine trees 9 to 11 inches and up in diameter at 22 feet from the ground. Several contracts of this nature were made on the basis of from 6 to 10 cents per tree.

With the advent of the pulp industry, spruce stumpage increased rapidly in value and as the supply of merchantable pine timber became smaller, the mills started to cut spruce, in spite of its much lower value.

Although the usual procedure for contracting for timber in the State forests is to make bids in competition with other mills, the Government may make special arrangements in some cases. All dealings in Government timber are made public.

In some districts the competition for timber in the State forests is very keen and the minimum prices fixed by the Government may be exceeded in some cases by 30 to 75 per cent. However, in extensive areas in the northern part of Sweden, the bids are very low, owing to the unsatisfactory transportation facilities for saw logs and also to the comparatively few sawmill and pulp operators in this part of the country. It is claimed that there has sometimes existed an agreement among the bidders on the timber in the State forests to regulate the price of stumpage. This is, however, a matter of much discussion. In the other parts of Sweden, where a large number of sawmills and pulp mills are in operation, such combinations have been difficult to establish, because some one always sees it to his advantage not to adhere to such agreements, thereby breaking the ring. The large percentage of unsold timber offered for sale by the Government can not be attributed exclusively to these combinations but is due to the unsatisfactory logging conditions in remote districts.

According to official statistics, the quantities of unsold logs offered on the market by the Government, were as follows from 1911 to

1915: 1911, 488,000 trees; 1912, 300,000 trees; 1913, 263,000 trees; 1914, 679,000 trees; 1915, 596,000 trees. For 1918, the quantity was estimated at 1,800,000 trees.

It must be taken into consideration that logging operations were carried on with a great deal of difficulty in Sweden during the latter part of the war on account of the scarcity of food for the loggers and of feed for the horses. This situation may to a certain extent account for the quantities of unsold timber being so large.

The Government has been considering the establishment of sawmills and pulp mills in northern Sweden in order to increase the proceeds from the operation of the State forests. It is not believed, however, that the Swedish Government will enter upon such activities to the same extent as the Finnish Government, since Swedish lumbermen feel that the Government should not compete with them in foreign fields, because the exporters are handicapped by heavy taxes, etc. On the other hand, it is certain that the Government will increase the output of saw logs for sale instead of selling standing timber and this step will be looked upon with favor by all concerned.

Particularly in the State forests, it has been found risky at times to bid on standing timber, because the timber is often rotten and this defect may not be discovered before the timber has been cut. By buying saw logs, the purchaser knows exactly for what quality he is paying and he takes less chance in this way.

Logging contracts previous to 1889, were made for a time extending even to 50 years. In that year, however, a logging contract was limited to 20 years, and in 1905 the limit was changed to 5 years.

In the private forests, usually more favorably located, the forest owners generally obtain the highest value for their timber, as the competition is very keen. There may be cases, however, when private forest land is surrounded by the property of one forest owner, who is practically the only one in a position to log at a reasonable cost. In such circumstances, stumpage values may be much below normal.

Standing timber is purchased only after being cruised; this was not usually done years ago. Both the seller and the buyer make cruisings.

Logging contracts are similar to those in effect in Finland but the marking of trees for cutting must be made more carefully on account of the more stringent laws in Sweden with regard to cutting.

Many sawmills in northern Sweden in years past made contracts with peasants owning timberland for the cutting of all trees above a certain dimension. These contracts were frequently made with stipulations that the peasants should be entitled to cut sufficient timber for their own personal use and for the use of their properties. During recent years the logging companies have often made amendments in these contracts, either by shortening the contract or by arranging to have the peasants refrain from cutting timber for their own use, in exchange for compensation in some other form. The value of stumpage has gone up to such an extent that it has been found mutually advantageous to modify the original contracts.

Courtesy of Forester O. Eneroth.

FIG. 19.—EIGHTY-FIVE-YEAR-OLD PINE FOREST IN DALECARLIA DISTRICT AFTER SECOND IMPROVEMENT THINNING.

Courtesy of State Forest Laboratory, Stockholm.

FIG. 20.—EXCEPTIONALLY FINE STAND OF OAK, SOUTHERN SWEDEN.

Courtesy of State Forest Laboratory, Stockholm.

FIG. 21.—CLEAN-CUTTING SYSTEM, LEAVING MOTHER TREES.

FOREST MANAGEMENT.

The forests owned by the larger wood-using industries and estates are generally well managed and some of them have been under scientific management for generations. The larger forest owners frequently prepare detailed maps of their holdings, showing the stands, annual increment, previous cutting, plans for draining, etc. For the best managed forests, plans for cutting are often made 25 to 50 years ahead. The owner may come back to the same tracts of land after a certain period and find a new crop. Many companies also maintain private nurseries.

The management of the forests is generally placed in the hands of trained foresters, who devote their time exclusively to forest management and to logging, floating, etc. Considerable money is also set aside for planting, seeding, and draining and the reforestation of cut-over territories is not merely an optional matter with the forest owner but, as seen from a previous chapter, it is in most cases compulsory by law.

In many forests in Sweden it has been noticed that the age for cutting saw logs has been reduced from, for instance, 130 years, before rational management was instituted, to 100 or 105 years.

It is very noticeable in Sweden that forest owners sometimes make improvements in their forests without any prospect of obtaining a direct financial return during their lifetime. On the other hand, the improvements indirectly benefit them, because if, for instance, a sawmill company has cut its forests recklessly its stock quoted on the exchange will immediately suffer.

There are great plans in Sweden for draining and reforesting swamp lands. In connection with the draining and reforestation of swamps, the name of Dr. Frans Kempe should be mentioned. Dr. Kempe has no doubt accomplished more in this respect than any other man in Europe, and thousands and thousands of acres in central Norrland have been drained through his efforts.

Figure 8 shows a section of a spruce tree cut in central Norrland on drained land. Before the area was drained, the growth showed 12 annual rings for the first one-fourth inch from the center. After the land was drained the trees showed a growth of 14 rings for the first inch and 8 rings for the next inch, 5½ rings for the following inch and 4 rings per inch for the last two inches before it was cut. It is remarkable to see what results have been accomplished in this regard, considering the fact that these forests grow in about the same latitude as Nome in Alaska. Even for southern latitudes this would be remarkably quick growth.

This illustration gives a good idea of the ambitious plans of the Swedish forest owners. By draining the swamp lands in northern Sweden, it is expected that in time Sweden would be able to grow on these areas alone forests almost sufficient to supply its present demand. It is expected that the Government will take a very keen interest in these matters in years to come, provided the increasing revenues from the State forests continue. It may be mentioned that large areas in Germany and other continental European countries which once were swamps and marshes at present produce some of the best forest stands in Europe.

Rational forest management has been practiced only by the larger private forest owners and the wood-using industries possessing forest lands. It can not be said, on the other hand, that the smaller stands, particularly in southern Sweden and the coastal regions of Norrland, have been cut in accordance with rational forest management. Therefore strict laws that have been passed recently will severely affect the management of the smaller holdings, but the larger timber holders will not be materially affected.

CUTTING SYSTEMS.

The underlying purpose of all cutting systems in Sweden is to make the stands yield the largest possible financial return on the capital invested. To accomplish this result, the cutting must be conducted along scientific lines.

In well-managed forests in Sweden, much importance is attached to improvement thinning, which usually starts when the trees have attained the age of 30 to 50 years. Old, defective trees are removed and also trees that stand too close to their neighbors. Generally speaking, in good stands at least 20 per cent of the trees can be removed during the first thinning.

When the stands attain an age of 60 to 90 years, the growth in height generally ceases and the cutting is effected with a view of giving better growing conditions for the surrounding trees so as to improve their form and size. Particularly in pine forests, it is necessary to cut the trees in such a way that sunlight can penetrate the tree crowns. This cutting system is not followed in spruce forests, where the general rule is that the crowns of the trees must touch each other. Cutting of this nature may be repeated every tenth year.

During the war an acute shortage of coal was experienced in Sweden and even as high as $80 per ton was paid for this commodity. The Swedish Government therefore had to take steps to obtain wood for fuel, and special commissions were appointed for this purpose. In one year more than 400,000,000 cubic feet was cut for fuel purposes.

The system followed was mainly improvement thinning, which had a beneficial effect upon many forests whose owners had not paid much attention to this cutting system. In one forest region in central Norrland it was found, for instance, that the Fuel Commission cut about 800 cubic feet per acre (55 cubic meters per hectare) without deviating from this improvement-thinning system.

Clean cutting of large areas can not be effected in Sweden on account of the law. When clean cutting is practiced it is done only on limited areas, 25 to 40 acres, and reforestation is effected by planting, seeding, or natural reproduction. In the last case mother trees are left on the cut-over area. The number of mother trees per acre depends upon local conditions, and the clean-cut areas must not be made too large; otherwise the stands may be severely affected. Mother trees are not often left on clean-cut areas of spruce forests, because they are liable to be blown down or otherwise damaged when standing isolated, the reason being that spruce roots do not extend very far into the ground. Reforestation of cut-over spruce land, therefore, is nearly always effected by planting or seeding.

The system of clean cutting is practically limited to even-aged stands of mature forests. Where the mature stands have an under-

growth of young trees this system can not generally be applied with profit. The result of the clean-cutting system is even-aged forests.

This system has several advantages, among which are the ease with which the cut-over areas can be planted and seeded and the comparatively small cost of reproduction. The disadvantage of this cutting system is that clean-cutting fells many trees that have not reached the age of maturity and thereby causes the owner a financial loss.

Small patches of about one-half acre are sometimes clean-cut and reproduction is left to nature by seeds from the stands at the edges of the clean-cut patches. The forests cut in this way will be many-aged, as contrasted with the even-aged stands growing up after clean-cutting over larger areas. As the clean-cut areas are very small, they are not exposed to winds and the many-aged stands that grow up after this cutting system has been practiced for some time are more resistant to fires, storms, etc. There are also no expenses for reproduction.

Dimension cutting is very unscientific and has no connection with rational forest management. Nevertheless this system of cutting is commonly practiced in Sweden, particularly in small and poorly managed timber holdings. All trees having a larger diameter at breast height than is specified as the minimum in the logging instructions are cut with no regard to other conditions. It is evident that many important rules of forestry are disregarded when this cutting system is employed. Mother trees that should be left for the natural reproduction of the forests, shelter trees that should protect the young stands against the elements, etc., are all cut alike if they are of the required size, whereas scrubby growth and defective trees are allowed to remain in the forests. When this cutting system is repeated the forest is soon stripped of its stands of merchantable timber and the conditions are made extremely unfavorable for reproduction. For it is evident that when the natural reproduction of the forest is left to abnormal and defective trees, the quality of the timber of the new growth must be greatly impaired. In rationally managed forests, the best trees in the stands are left as mother trees, but this is not the case when dimension cutting is practiced. Dimension cutting, therefore, is primitive and incompatible with the rules of scientific forest management.

FELLING THE TREES.

PLANNING THE SEASON'S CUT.

Usually all the larger sawmills possessing forest land maintain special branches devoted to the management and operation of their forests. Before each logging season, the forest owner must carefully plan the season's work. The plan for cutting may cover a number of years in advance. During the summer and the early autumn, the trees to be cut the following season are marked. The forest area to be logged is carefully cruised, logging roads are surveyed, obstacles such as stones are blasted, bridges are built, etc. From the main logging road, a number of branch roads deviate. The laying out of a system of logging roads is very carefully done with a view to eliminating hills, etc. In southern Sweden, the roads must

be made more permanent on account of the lack of snow, but in northern Sweden the snow cover makes such steps unnecessary.

The territory to be logged over is divided into sections, one of which is alloted to each crew of loggers, and log cabins, etc., are constructed. The marking of the trees for cutting is left to experts and must be done in accordance with the laws in the Province where the logging is carried on. The trees are marked with a distinguishing brand, of which each mill has one. The trees are marked either at breast height only or both at breast height and as close as possible to the root. Sometimes logging contracts stipulate that trees shall be marked at breast height on opposite sides of the bole. If the areas are to be clean cut, the trees are usually not marked. The person marking the trees is also required, as a rule, to keep an account of the number of trees to be cut and their dimensions, in order to enable the mill to estimate intelligently the stocks of lumber that may be sawn in the near future.

The logging operations are restricted to the winter months; no logging is carried on during the spring, summer, and autumn, because at these times the logs are liable to discolor. The snow greatly facilitates the transportation of the saw logs, and the logging operations generally start in November or December, as soon as the ground is frozen and the first snow has fallen. The logging operations last three to four months in southern Sweden and six to seven months in the northern Provinces.

The snow cover is very light in southern Sweden and often the snow does not stay on the ground for any length of time. The snow cover in central and northern Norrland is usually 1½ to 2 feet and in northern Norrland, 4 to 6 feet.

In southern Sweden the logging operations are concentrated along the railroad lines, because the transportation of saw logs in the rivers is not satisfactory there. In northern Sweden the distance from the nearest floating river is seldom more than 5 to 8 miles.

The cutting and driving of logs are usually given out on contracts. These contracts may be based on the number of saw logs, irrespective of dimensions, or on the cubical contents of each log. The latter seems to be the more satisfactory arrangement.

The sawmill companies may make arrangements with one foreman, who signs the contract and who hires his own crew and furnishes his own horses and equipment. The company does not take any active part in the logging operations outside of supervising from time to time the progress of the work. In normal times, however, the companies sometimes give assistance to the foreman by maintaining roads during the winter, etc. During the war, the difficulty of securing horse feed and food supplies made it necessary for many sawmill companies to spend large amounts of money to procure these commodities in order to carry on logging operations.

It is noticeable in Sweden that the large forest owners have made an effort to secure a permanent staff of operators in the forests. These companies have often rented to loggers, at a nominal rent or none at all, farms located in the forests, on condition that the loggers place themselves at the disposal of the company during the logging operations in the wintertime, provided that the company pays the standard wages that could be obtained from other parties in the same

locality. This arrangement has given satisfaction to both parties concerned and has proved very successful.

FELLING METHODS.

The districts most remote from the waterways are logged first. Logging is usually suspended when the temperature is lower than 4° below zero, because the trees are liable to break in felling. The logging methods in Sweden are about the same as those employed in Finland and Norway. The character of the country, the relatively small stands of timber per acre, and the cutting systems combine to make the use of complicated logging machinery very difficult. The felling of the trees is done by hand, as no satisfactory tree-felling machines have been found. A number of types of drag saws have been tried from time to time but there seem to be drawbacks that make the use of these machines undesirable. Some machines require two men for their operation and in other cases the machines are too heavy to be moved around quickly on account of the snow. In most cases the felling of trees by machines has proved more expensive than felling by hand.

In felling trees saws are now used almost exclusively in Sweden, because the waste is less than when felling is done with axes. Usually two men operate each saw but in some places only one man does the work. In some cases, the one-man saw has a spiral spring attached to the end of the saw and fastened to the tree, which greatly facilitates the sawing operations.

In the better managed private forests, the height of the stumps does not exceed 3 or 4 inches above the frozen ground (not above the snow cover). In order to accomplish this result the loggers must shovel the snow away before cutting. Fines are usually imposed for stumps in excess of the stipulated height.

Particular care is taken not to damage the surrounding young forests when trees are felled. If the trees show any traces of decay, the loggers must saw off pieces at the butt end from 1 to 2 feet in length until the decay is removed. For this work a small compensation is often paid. It is evident that by the exercise of care in this respect, the cost of floating and handling will be decreased, as it is a loss to bring a rotten log to the mill, to incur the same charges for handling as sound timber.

After the tree is felled, it is limbed from the butt toward the top and is then barked. The barking is done with a special implement shaped like a spade with a sharp edge. Barking is compulsory by law in many sections of Sweden but in the northern Provinces the law makes certain exceptions.

There are several reasons for the compulsory barking of logs. It is contended that the accumulation of bark in the floating rivers is injurious to the fish, although on this point opinions vary. At any rate, during floating the bark loosens and fills up the rivers. For the sawmill owner, it is often important to have the logs barked, because unbarked logs are liable to accumulate sand, which is injurious to the saw blades in the mill. Furthermore, barked logs are more easily handled and prevent an accumulation of refuse at the mill. Unbarked logs are liable to tint the lumber, giving it a brownish color, which impairs the appearance. The barking of logs entails, however, considerable expense, to which there is often strong

objection. This increased expense of logging is a handicap to many forest owners in remote districts, because it hampers the utilization of small-dimension timber. Spruce logs are seldom barked.

According to Forester W. Ekman, one man can cut, limb, and bark the following number of logs of different dimensions, during a day of 9½ to 10 hours:

Log lengths.	Top diameter (inches).									
	6	7	8	9	10	11	12	14	16	18
15 feet	32	26	21	17	14	12	10	8	7	6
17 feet	28	23	19	15	13	11	9	7	6	6
19 feet	25	21	17	14	12	10	8	7	6	5
21 feet	23	19	16	13	11	9	8	6	6	5
23 feet	22	18	15	12	10	9	7	6	5	5
25 feet	21	17	14	11	9	8	7	6	5	4
27 feet	20	16	13	10	9	8	7	5	5	4

In general, it may be said that in the better stands an average of 1½ to 2 saw logs from each tree may be obtained. In the coastal and mountainous districts, however, one log from each tree may be the average.

CROSSCUTTING.

When the tree is limbed and barked, it is crosscut to log lengths. This is one of the most important operations in the forest, and special expert crosscutters have been used for this purpose in Sweden for a number of years in the most efficiently operated forests. Inefficient crosscutting methods may cost the company thousands of dollars and an ordinary logger might be more or less careless in this respect. The extra expense, however, causes many mills to do without the special crosscutters.

The sawing schedules are based on the top diameter. It is therefore necessary to produce such top-diameter dimensions as will give the best results when the logs are cut into lumber. Special crosscutting tables are made up by the mills, based on the market prices of lumber and also taking into consideration the probable future trend in the prices of the different widths. The crosscutting is effected in accordance with these tables, and the crosscutter and the mill superintendent are in constant touch with each other during the logging season, in order to obtain an output of the most suitable log dimensions.

The smallest top diameter of saw logs varies a great deal and is determined mainly by the cost of logging and floating. On an average, saw logs are seldom cut less than 4 to 5 inches in top diameter; this applies only in districts where the cost of logging and floating is moderate. In other districts, the minimum top diameter may be 6 inches. The competition from pulp mills may tend to increase the minimum top diameter in many instances.

The remainder of the tree (top logs) is carefully utilized as a rule, being cut into props, charcoal logs, or pulp logs of various lengths. If the log is crooked, it must be crosscut at the bend, unless the mills have special apparatus for sawing crooked logs. Efforts are also made to crosscut logs in such a way that the clear will be separated from the defective part of the tree, provided the average

log lengths will not be impaired by this procedure. The mills that classify the lumber into more than three grades are particularly careful in this respect.

If the taper of the log is large, the log lengths are made small because in sawing long logs with a large taper the waste is disproportionately great.

The log lengths are cut on odd and even feet, giving from 6 to 8 inches excess to provide for damage during floating. As the lumber for export is sold on an average-length basis, no attention is paid to obtaining any special standard of log lengths. The most important markets for Swedish lumber employing the English measurements, the saw logs are cut to English feet and inches. Logs are seldom shorter than 9 to 10 feet; the maximum length varies a great deal and is usually governed by the conditions of floating. In most of the Swedish rivers the charges for floating long logs are very heavy and the timber is liable to break while en route to the mill. Therefore, the maximum lengths of logs floated in Swedish rivers may be 28 to 29 feet. The crosscutter must endeavor to obtain an average length of about 18 feet.

The top diameters are usually cut on the half inch and in some cases the most efficient operators crosscut on the quarter-inch diameter. The top diameters most in demand are as follows: Pine, 8, 8¾, 9½, 10, 11, 13, and 15¼ inches; spruce, 7¾, 8½, 9¾, 10¾ 12¾, and 15 inches.

The following is a sample of the instructions for crosscutting logs:

	Minimum top diameter (inches).
Pine in lengths of—	
13 to 29 feet	6
11 to 12 feet	8½
9 to 10 feet	9
Spruce in lengths of—	
15 to 29 feet	7
13 to 14 feet	8
9 to 10 feet	9½

In some districts in Sweden great importance is attached to obtaining long lengths, thereby lessening the cubical contents of the lumber obtained when these logs are sawn. These mills have special markets for lumber of long lengths, but it is generally contended that although they obtain an increased price for such stock the waste in cutting long lengths in the mill is disproportionately large and the increased prices could scarcely make up for loss in material.

It is generally estimated that one crosscutter can take care of the output of 8 to 10 loggers. The crosscutter may also be called upon to keep an exact account of the number of logs and log dimensions cut in order to enable the mills to be posted on the progress of the logging operations and to plan the following season's cut of lumber.

To understand the importance of efficient crosscutting methods, it is necessary to consider the scale of prices of lumber of various widths. Some dimensions, 11 and 9 inches, for example, are much in demand and command higher prices than, for instance, 8 and 10 inch stock, which is wanted by only a few markets. The following example may be given to illustrate the economic loss caused by an inefficient system of crosscutting, the values given being in accord-

ance with the average value of saw logs before the war: An average pine tree about 60 feet high and 12 inches in diameter at breast height, with a taper of about 1 inch in 9 feet, may be crosscut as follows:

	Value.
Alternative I:	
1 log 15 feet long and 10 inches at the top	$1.20
1 log 17 feet long and 7 inches at the top	1.20
1 log 17 feet long and 3 inches at the top	1.20
Alternative II:	
1 log 25 feet long and 8 inches at the top	.95
1 log 25 feet long and 3 inches at the top	.95
Alternative III:	
1 log 19 feet long and 9 inches at the top	.91
1 log 27 feet long and 4 inches at the top	.91

Thus a loss may ensue from a faulty system of crosscutting of as much as 29 cents on one tree, not considering the top log, which is used for coal or fuel and which often is of small value.

In no other country is the system of crosscutting so developed as in Sweden. In Russia, for instance, where about the same kinds of trees grow, most of the logs are crosscut to about the same lengths, the comparative value of the lumber to be sawn from various log dimensions not being taken into consideration.

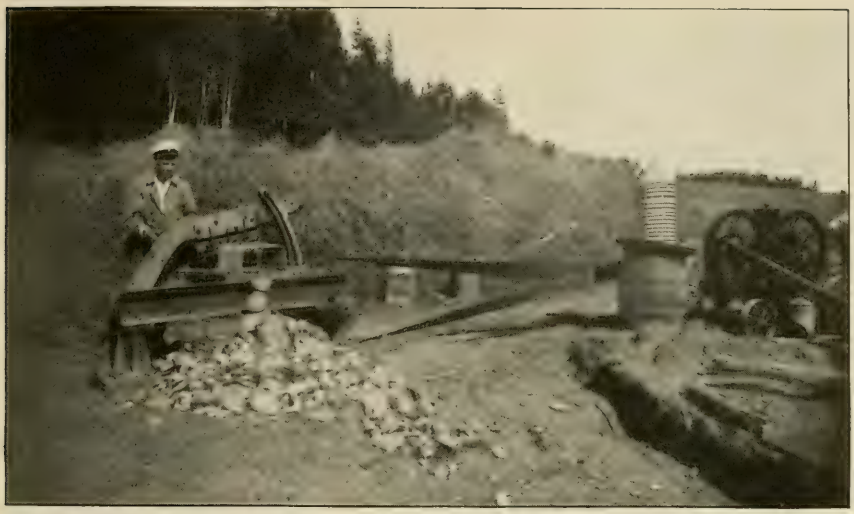
UTILIZATION OF ALL PARTS OF TREE.

The efficiency in the utilization of even the smallest top log is surprising and the utilization is becoming closer and closer each year as the cost of stumpage increases and the floating facilities are improved. In most of the favorably located forests in Sweden, practically nothing is left in the forest after cutting. Even the bark, branches, and roots are utilized for fuel, tar, etc.[5] In some districts, bark, branches, etc., are compressed into briquet for fuel.

During the war a very close utilization of small top logs was instituted. About 40 top logs were made up into a bundle 10 to 11 feet long and 15¾ to 23½ inches in diameter. These bundles are strapped with iron wire, for which purpose a special machine has been constructed, costing about $70. Three men can put up 50 bundles per day by using this machine and one company alone put up 35,000 bundles of this material in 1918. The cost of bundling was about 15 to 25 cents a bundle in 1918–19. The bundles were floated to the nearest charcoal plant where this material was manufactured into charcoal. One of these bundles may be classified at approximately one-fifth of a standard log, and the charge for floating has usually been about 10½ cents per bundle, though there was considerable variation. The percentage of sunken bundles was less than one-half of 1 per cent. The whole undertaking was so successful that a number of operators in Sweden have followed up the success of the first trial, which was made in the Dal River.

It is figured that the forest owners obtained a net profit in 1918 of approximately 1½ cents per cubic foot by selling these bundles to the charcoal plants, but in this calculation stumpage has not been included. It is difficult, however, to fix any amount for stumpage, as these top logs would probably have no value except for this purpose.

[5] The roots are either blasted or pulled out of the ground. During the war as high as 20 cents per cubic foot was paid for the roots, based on the measurement of the roots in piles.



Courtesy of State Forest Laboratory, Stockholm.

FIG. 22.—CHOPPING BRANCHES AND WASTE INTO FIREWOOD.

Courtesy of State Forest Laboratory, Stockholm.

FIG. 23.—PULLING ROOTS.

Courtesy of State Forest Laboratory, Stockholm.

FIG. 24.—BURNING CHARCOAL.

FIG. 25.—RIGID INSPECTION OF HEIGHT OF STUMPS.

By disposing of them in this way, the forests are cleaned up and waste is turned into profit.

In no other country in the world, not even in Germany, can small-dimension top logs, etc., be utilized to so great an extent as in Sweden. This is due to the cheap transportation, both in the forests and from the forests to the mill, and to the excellent market that can usually be found in Sweden for such stock, which is used for charcoal, pulp, props, etc. Before the war the iron industries alone consumed 120,000,000 bushels of charcoal, valued at $7,775,000, annually.

DRIVING.

The transportation of logs to the nearest waterway is done by horses. Only in one or two cases are small logging railroads used in central Sweden, where the limited amount of snow greatly hampers the transportation by sledges. Recently a company was formed in Sweden to put into operation a new mechanical-transportation system for saw logs. It appears, however, that this system is the same, in the main, as the system used in the United States for transporting logs by rail; but it is adapted to Swedish conditions. It is believed that the mechanical transportation of saw logs will make good progress in Sweden on account of the topographical conditions. The Swedish Government is reported to have taken steps to use German army trucks for log hauling in the State forests.

The driving of logs starts as soon as the snow covers the ground in sufficient quantities to facilitate sleigh driving. The sleighs used vary in construction in the various parts of Sweden. Usually the equipment consists of two sleighs connected with a chain. The one in front is about 6 feet long and provided with an immovable bar on which the logs rest, thereby enabling the driver to make sharp turns. The rear sleigh is 7 to 11 feet long. The load is secured by a special binder, now used instead of spikes, which previously were driven into the logs in order to fasten the chains. These spikes often broke during cold weather and the spike left in the saw log caused a great deal of trouble in the sawmills when the saw blade struck the piece of steel.

The logs are generally assembled at one central point along the main logging road, where they are loaded on sleighs and driven down to the water. The equipment used for hauling the logs from the stumps to the assembling point is a small sleigh on which the top end of the log is chained, while the remainder of the log is dragged on the ground.

The loads vary considerably in size. According to Forester W. Ekman, the average loads in Sweden are the following: Seven-inch top-diameter logs, 65 cubic feet per load; 12-inch top-diameter logs, 80 cubic feet per load; 12-inch top-diameter logs, 92 cubic feet per load.

The number of trips per day depends, of course, upon the distance. According to Forester O. Eneroth, the following schedule may be considered as normal in Sweden: Up to 1.9 miles, 4 trips per day; 1.9 miles to 2.5 miles, 3 trips per day; 2.5 miles to 4.4 miles, 2 trips per day; 4.4 miles to 10 miles, 1 trip per day. It is impossible, of course, to give anything but a rough estimate, as the topographical conditions determine the progress of the driving.

The horses used in forest operations in Sweden are remarkably adapted to logging conditions. They are sturdy and excellently trained for the difficult work in the forests.

When the logs have been taken down to the waterway they are piled either on the ice or on the bank and are given a solid foundation of two parallel logs placed at right angles to the tiers of the other logs. At least once a week the saw logs are scaled by the company's inspector and the logs are provided with a dozen or more brands along the entire length, in order to enable the floaters to separate them readily according to ownership.

When saw logs are sold delivered at the river bank, they are often measured by members of an organization of measurers established by the purchasers of saw logs in order to avoid haphazard purchasing methods. Formerly logs were frequently measured in different ways in the same district and the buyer would not exactly know what he was getting. This system often led to unfair competition among log buyers, which the present impartial measuring system was established to eliminate. The cost of measuring of saw logs generally varied from one-half to three-fourths cent per log before the war; it was 50 to 75 per cent higher in 1918–19.

Reindeer are used for log hauling to some extent in the northernmost parts of Sweden. The reindeer is a comparatively small animal but it possesses remarkable strength, and it is generally figured that two reindeer are capable of performing the same work in the forests as one horse. The average loads may be 30 to 40 cubic feet of logs. The reindeer does not possess the endurance of a horse and the distance covered in hauling seldom exceeds one to two miles. The advantage of using reindeer is that the feed question is easily settled, as the reindeer lives on moss and similar vegetation growing in the northern regions. Sometimes forest owners hire a herd of reindeer to trample the logging roads after a snowfall—an effective and cheap way of road building.

After the logging operations are finished in the spring, the logging areas are inspected by the company to see if the logging contracts have been carried out properly. Fines for careless cutting, etc., are decided upon and final settlement is made with the logging foremen. The logging foremen generally receive an advance of money before the logging operations start and part payments on the logging contracts are made during logging operations in the winter.

LABOR AND WAGES.

In every country there is some occupation in which the inhabitants have special proficiency, and it does not take a stranger long to find out that it is the handling of timber and lumber in which the people of Sweden excel. The Swedish loggers are hardy, have great endurance, and are very proficient in their work.

Mention has been made previously of the endeavors of the Swedish forest owners to build up a permanent staff of loggers on their timberlands. Besides these permanent workers, there is always a large floating population moving from district to district and engaged in logging in the winter, floating in the spring, and farming in the summer.

Working and living conditions in the forest regions in Sweden have been generally satisfactory. Good money has been earned by the loggers because the cost of living in Sweden was low before the war and the loggers were able to save the greater portion of their wages.

According to official statistics, the following wages were paid to different kinds of workers in the various districts of Norrland and central Sweden in 1913, 1917, and 1918. Conversions here and throughout this report have been made at the normal rate of 26.8 cents to the Swedish crown:

Districts.	Fallers.					Drivers (with horse).				
	Average wages per day.			Increase.		Average wages per day.			Increase.	
	1913	1917	1918	1913 to 1918.	1917 to 1918.	1913	1917	1918	1913 to 1918.	1917 to 1918.
				Per ct.	*Per ct.*				*Per ct.*	*Per ct.*
Bergslag	$0.83	$2.04	$2.46	195.8	20.2	$2.25	$4.23	$6.22	175.8	46.7
Gevle-Dala	1.16	2.98	4.88	323.0	63.6	2.50	7.32	12.60	402.7	71.9
Central Norrland	1.04	2.49	3.51	237.6	40.9	2.16	6.43	9.62	345.4	49.9
Hernosand	.87	2.42	3.38	287.7	39.5	1.94	6.00	9.27	377.2	54.5
Umea	.87	2.22	3.46	298.2	56.3	1.94	5.98	9.26	376.7	54.8
Skelleftea	.92	2.36	3.15	243.6	33.4	1.78	5.47	8.84	397.7	61.9
Lower Norrbotten	.91	2.79	4.00	337.5	43.5	1.80	5.65	7.96	341.2	41.0
Upper Norrbotten	.91	2.17	3.47	280.1	60.4	1.80	4.90	7.83	334.0	59.7
Average, Norrland and central Sweden	.96	2.43	3.55	271.4	46.4	2.03	5.71	8.71	330.2	52.4

The following information is given in regard to the wages in various districts of southern Sweden in 1918:

Districts.	Fallers.	Drivers (with horse).	Districts.	Fallers.	Drivers (with horse).
Sodra	$1.95	$5.33	Vestra	$1.87	$5.63
Smaland	2.22	5.78	Ostra	2.20	5.53

It is thereby seen that southern Sweden had considerably lower wages than northern Sweden, but the logging operations are not important in these districts. Cases were known in districts of southern Norrland where as high as $20 to $22 per day was paid in 1918 to saw-log drivers with horse.

In southern Sweden the low wages may be explained to a great extent by the fact that the loggers are more permanent employees than in northern Sweden and, besides their wages, these people obtain other benefits, such as the use of farms and other properties at very low rent.

It may be of interest to consider the statement following covering the cost of the necessary food supplies per man (about 4,300 calories per day) in the forest regions of central Sweden during 1914 and 1918–19.

Articles.	1913–14	1918–19	Articles.	1913–14	1918–19
2.2 pounds margarin	$0.40	(a)	0.2 pounds coffee	$0.05	$0.20
4.4 pounds rye bread	.24	$0.54	1.1 pounds dried fruit	.27	(b)
1.1 pounds salt pork	.19	$0.80–1.07	Tobacco, etc	.40	.80
2.2 pounds wheat flour	.10	.13			
2.2 pounds oatmeal	.15	(b)	14.5 pounds (4,300 calories per day)	1.90	
1.1 pounds sugar	.10	.13			

a Usually not obtainable. b Not obtainable.

Besides these articles, the loggers generally brought with them from home different farm products, such as milk.

The prices of hay and oats during the same periods were as follows: Hay, 1 to 1.3 cents per pound in 1913–14 and 7.3 to 8.5 cents in 1918–19; oats, 2.2 to 2.7 cents per pound in 1913–14 and 9.7 to 14.6 cents in 1918–19. The prices for hay and oats are not in accordance with the maximum prices fixed by the Government; but all over Sweden only limited quantities were available at the Government rates. Many people sold both food and feed stuffs at higher prices, in spite of the energetic efforts on the part of the Government to check these practices.

The importance of the forest to the Swedish nation was particularly manifested during the war, when Swedish scientists produced a feed substitute made of wood pulp. It is said that this substitute horse feed enabled the loggers to continue logging operations.

COST OF LOGGING.

To obtain an average figure of the cost of logging covering the whole country is almost impossible because conditions differ in the various sections. The following statement, compiled by Prof. G. Lundberg, gives the index numbers showing the relative cost of logging for logs of different top diameters, in most districts, if the 8-inch top diameter is taken as the basis (1.00):

Operations.	Top diameter (inches).										
	5	6	7	8	9	10	11	12	13	14	15
Felling, barking, and limbing	1.41	1.20	1.09	1.00	0.93	0.87	0.82	0.78	0.74	0.70	0.67
Driving, average haul, 2 to 2½ miles	1.44	1.26	1.12	1.00	.90	.82	.76	.71	.67	.64	.62

The following detailed statement of the cost of logging, per cubic foot, during 1913–14, 1917–18, and 1918–19, in a district of southern Norrland is believed to be representative of standard logging operations in the principal districts of Sweden. The variations between this district and certain other districts in Sweden may be due largely to special local conditions.

Items.	1913–14	1917–18	1918–19
	Cents.	*Cents.*	*Cents.*
Cutting (based on average logs 8 inches at top, 17 feet long, limbing, barking, and crosscutting)	0.880	1.870	2.250
Transportation (driving logs to waterway, average 2 trips per day)	1.550	4.230	5.110
Total	2.430	6.100	7.360
Overhead charges and general expenses:			
Marking trees for cutting and log scaling at river bank	.080	.100	.147
Surveying	.040	.050	.059
Supervision of logging	.080	.182	.201
Road-construction camps	.080	.160	.201
Inspection after logging	.003	.013	.016
Liability insurance	.013	.016	.016
Dumping logs into river	.003	.067	.080
Total	.299	.588	.720
Stumpage	4.290	9.657	10.440
Grand total cost of getting logs to river bank	7.019	16.345	18.520

AVERAGE LOG DIMENSIONS IN DIFFERENT DISTRICTS.

When the lumber export trade started on a large scale a little more than half a century ago, there were large areas of virgin forests in Norrland. During the first years of logging in this region no trees yielding logs less than 12 inches in top diameter were cut. Since that time, however, the saw-log dimensions have been steadily decreasing as the prices of stumpage have advanced.

The following schedule gives the result of an investigation of the present average saw-log dimensions covering many standard operations in different parts of Sweden:

Districts.	Average top diameter.	Average length.	Districts.	Average top diameter.	Average length.
Northern Norrland:	*Inches.*	*Feet.*	Central Norrland:	*Inches.*	*Feet.*
Haparanda, Lulea, Pitea, Skelleftea	8½–8½	18–18½	Hernosand, Sundsvall	7¼–7¾	18½–19½
Umea, Ornskoldsvik	7 7½	17–18	Southern Norrland: Hudiksvall, Soderhamn, Gevle	8	17½
			West coast	7 –8	15–16¾

An investigation in several of the principal logging districts of Norrland gives the following results in regard to the percentages of pine and spruce saw logs of various top dimensions: 5 to 6 inches, 27 per cent; 6 to 7 inches, 20 per cent; 7 to 8 inches, 17 per cent; 8 to 9 inches, 13 per cent; 9 to 10 inches, 14 per cent; 10 to 11 inches, 4 per cent; 11 to 12 inches, 3 per cent; 12 to 13 inches, 2 per cent.

In four districts in southern Norrland it was found that the percentages of pine and spruce logs of different lengths were as follows: Spruce in lengths of 10 to 13 feet, 7 per cent; in lengths of 14 to 21 feet, 88 per cent; and in lengths of 22 to 29 feet, 5 per cent; pine in corresponding lengths, 18, 71, and 11 per cent, respectively.

It is difficult to obtain a satisfactory statement covering the logs cut in any particular district, because these statistics have been compiled at the mills and nearly all the districts in Norrland take logs from adjacent districts and even from Finland.

In regard to the log dimensions in southern Sweden outside the west-coast district, it is impossible to give an accurate idea of the average dimensions, because the logs are cut by thousands of small operators, usually without regard to obtaining the most profitable log dimensions. The lengths are shorter in southern Sweden than in the other parts of the country; probably most of the logs are 14 to 16 feet long. They are seldom longer on account of the difficulty of transportation. Moreover, southern Sweden produces most of the lumber exported to the Danish market, which prefers lengths of 12, 13, 14, and 15 feet.

The dimensions of saw logs have been on the decline for years as the virgin forests are gradually being cut out. The following statement from some of the largest operations in Norrland gives an idea of the decrease of log dimensions from 1907 to 1917:

Years.	Average dimensions.	Years.	Average dimensions.
1907	8 inches by 19¾ feet.	1913	8 inches by 18½ feet.
1908	8¼ inches by 20 feet.	1914	8¼ inches by 18½ feet.
1909	7¾ inches by 19½ feet.	1915	8½ inches by 18½ feet.
1910	7¾ inches by 19¼ feet.	1916	8 inches by 18¼ feet.
1911	7½ inches by 19¼ feet.	1917	8¼ inches by 18¼ feet.
1912	8 inches by 19¼ feet.		

Many sawmills in Norrland take considerable quantities of saw logs from Finland. The Swedish mills often possess timber holdings in northern Finland, but most of the logs are contracted for from the Finnish State forests. As the Finnish timber is usually cut from virgin forests, it enables the Swedish mills to complete their stock lists with wide stock cut from the Finnish logs and thereby to enhance the value of the whole production of the Swedish mills. The Finnish timber is taken in whole tree lengths and rafted across the Gulf of Bothnia to Swedish ports. Not only the ports on the northern shores of the Gulf of Bothnia take Finnish timber, but even ports in central Norrland have for a long time contracted for large quantities of Finnish logs. This competition in saw timber is disliked by the Finnish sawmill operators but the Swedish sawmills usually can pay higher prices for saw timber than the Finnish mills, because the Swedish sawmills cut the lumber with a larger percentage of wane and can utilize the waste material to better advantage. The Finnish timber, however, sometimes shows decay and other defects. Energetic efforts are being made in Finland to check this exportation of saw logs to Sweden.

PRICES OF SAW LOGS.

The Swedish sawmills find it to their advantage to equalize their production of lumber by purchasing timber from other forests than their own. The competition usually is not only among the sawmills but also between pulp mills and sawmills. The base prices on saw logs delivered at the waterways are often stipulated by the local branches of the Swedish Exporters' Association, with a view to bringing about fairer methods in the purchase of saw logs. Although the mills may agree in regard to a certain maximum increase on these base prices, they have not been so successful in cooperating to purchase saw logs as in cooperating to sell lumber for export.

The base prices are generally fixed for logs delivered at a certain point on the main floating river. The price for logs delivered at other points is arrived at by deducting the difference in the floating charges between the two points. The buying of saw logs always entails a certain amount of risk to the sawmills because they are unable to tell what prices they may obtain for the lumber cut from these logs, as it nearly always takes from one to two and a half years for the saw logs to be turned into lumber for shipment.

At the time the purchase is made, an advance of about 10 per cent of the contract price is made and the balance is paid either in installments or upon delivery.

As the prices of cut saw logs will give a better idea of the value of the raw material in Sweden than a statement of the stumpage values with the cost of logging and floating, special attention will be given the matter of prices of saw logs.

The following table, compiled by Forester Örtenblad, shows the advance in the price of saw logs of different top diameters in the Indal River district, from 1855 to 1905. The prices are quoted per standard log 21 feet long:

Top diameters.	1855	1865	1870	1874	1875	1880	1885	1890	1895	1900	1905
12 inches	$0.39	$0.47	$0.54	$1.20	$0.67	$0.86	$0.95	$1.05	$1.13	$1.69	$1.74
11 inches	.09	.32	.43	1.07	.54	.72	.82	.91	.98	1.26	1.41
10 inches	.07	.17	.32	.94	.40	.59	.68	.79	.79	.96	1.13
9 inches	.....	.....	.19	.80	.27	.46	.44	.52	.54	.70	.84
8 inches	.....	.....	.13	.54	.13	.21	.24	.32	.34	.43	.56
7 inches	.....	.....	.....	.....	.....	.....	.....	.17	.20	.28	.34
6 inches	.....	.....	.....	.....	.....	.....	.....	.....	.....	.17	.17
5 inches	.....	.....	.....	.....	.....	.....	.....	.....	.....	.15	.15
4 inches	.....	.....	.....	.....	.....	.....	.....	.....	.....	.09	.....

This table is especially interesting because it shows that only logs 10 inches and more in top diameter were cut up to 1870. From that time to 1890 no logs less 8 inches in diameter were sold and from 1900 saw logs with top diameters down to 4 inches were considered as commercial sizes. This top-diameter limit has not been lowered at the present time.

It is difficult to tabulate the statistics of cost of saw logs in such a way that they can be compared, because the methods of measurement in the different districts vary considerably and the cost of floating also is a factor. If the logs are delivered at the upper course of the river, the price must be lower than if they are delivered close to the mills. The figures in the table following, referring to different districts, can not be compared with one another without taking into consideration the cost of floating, but they may separately indicate the increase in cost during the last few years.

The table following shows the prices of saw logs per cubic foot, delivered on the main floating river in various districts of Sweden for specified years, together with the percentage of increase each year over a stated price basis for each district. A standard pine log 8 inches in top diameter and 17 feet in length has been considered in making these calculations, the average contents being 5.93 cubic feet, based on top-diameter measurement.

The prices for spruce logs were in some cases on a par with those on pine and in other cases were somewhat lower or higher, according to circumstances.

Districts and years.	Price per cubic foot.	Increase.
	Cents.	*Per cent.*
Lulea (basis, per log, 27.9 cents):		
1913	6.4	35
1917	9.1	95
1918	10.0	110
Skellefteå (basis, per log, 30.8 cents):		
1914	7.8	50
1915	7.8	50
1916	9.1	75
1917	13.0	150
1918	15.6	200
Hernosand (basis, per log, 22.8 cents):		
1913	9.1	140
1914	10.0	165
1915	9.6	150
1916	11.5	200
1917	17.0	350
1918	23.2	500
1919	19.3	400
Hudiksvall (basis, per log, 36.2 cents for 1913 and 1914 and 34.8 cents for later years):		
1913	6.8	10
1914	7.1	15
Hudiksvall (basis, per log, 36.2 cents for 1913 and 1914 and 34.8 cents for later years)—Continued.		
1915	7.3	25
1916	8.8	50
1917	14.9	150
1918	14.9	150
Dalecarlia (basis, per log, 43.1 cents):		
1914	14.8	100
1915	14.8	100
1916	19.0	160
1917	19.0	160
Klar River (basis, per log, 41.3 cents):		
1913	8.5	20
1914	8.5	20
1915	11.1	60
1916	14.8	110
1917	20.0	185
1918	23.2	230
1919	33.9	385

A sawmill company in the Angermann River district reports that the following average prices in cents per cubic foot, had been paid for saw logs from 1907 to 1917: 1907, 7.2 cents; 1908, 8.5; 1909, 7.9; 1910, 8.7; 1911, 8.4; 1912, 7.9; 1913, 9.0; 1914, 9.0; 1915, 8.2; 1916, 10.7; 1917, 12.5. These prices, however, may be considered somewhat below the prices usually paid by other companies.

In other districts of central Norrland, the following prices were ruling for saw logs delivered at the mills, including floating: 1909, 7 cents per cubic foot; 1913, 8 cents per cubic foot; 1915, 9 cents per cubic foot; 1916, 11 cents per cubic foot; 1917, 15 cents per cubic foot.

When the prices of saw logs in one of these districts are compared for 1903 and 1913, the amount of increase in the latter year varies greatly in the different dimensions, as follows: 6 inches, 71 per cent increase; 7 inches, 50 per cent; 8 inches, 40 per cent; 9 inches, 27 per cent; 10 inches 14 per cent; 11 inches, 9 per cent; 12 inches, 8 per cent. The increase of the price of logs of small-top diameter was due to the heavy demand for these logs by the pulp mills.

In order to indicate how the top diameter effects the price per cubic foot, the following statement, showing prices per cubic foot for pine logs of different top diameters and different lengths, is given, delivered at Granvag (sorting basin), Hernosand district, in 1913:

Top diameters.	15 feet.	17 feet.	19 feet.	21 feet.	23 feet.	25 feet.	27 feet.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
5 inches	5.0	5.7	6.0	6.3	6.4	6.9	7.2
6 inches	5.7	6.0	7.1	7.4	8.2	8.9	9.5
7 inches	6.7	8.1	8.6	9.2	9.2	9.7	9.8
8 inches	8.3	9.6	10.1	10.5	10.8	11.1	11.4
9 inches	9.6	10.7	10.8	10.8	11.2	11.8	12.3
10 inches	12.3	13.0	13.3	12.2	13.6	14.0	14.3
11 inches	14.2	14.9	15.5	15.9	16.3	16.6	17.5
12 inches	13.0	13.8	14.3	14.6	15.2	15.3	15.3
13 inches	14.0	13.9	14.5	14.7	15.0	15.2	15.4
14 inches	12.5	12.9	13.2	13.4	13.3	14.0	14.3
15 inches	12.7	12.8	13.0	13.4	13.6	13.6	13.8
16 inches	12.8	13.1	13.1	13.1	13.4	13.5	13.6
17 inches	11.6	11.9	12.1	12.1	12.3	12.5	12.6
18 inches	11.3	11.3	11.8	11.9	12.0	12.1	12.3

FIG. 26.—DRIVING LOGS.

FIG. 27.—LOGGING CAMP.

FIG. 28.—CROSSCUTTING, BARKING, AND CUTTING OFF ROTTEN SECTION OF LOG.

FIG. 29.—LOGS PILED ON RIVER BANK.

Spruce logs cost 10 to 15 per cent less than pine.

The following table shows the comparative prices per cubic foot, in 1914 and 1918, of 19-foot pine logs of different top diameters, delivered on the main floating river in the Skelleftea district of the upper gulf region:

Top diameters.	1914	1918	Top diameters.	1914	1918
	Cents.	*Cents.*		*Cents.*	*Cents.*
5 inches	6.0	12.1	10 inches	11.3	22.5
5½ inches	6.0	12.1	10½ inches	11.3	22.5
6 inches	6.0	12.1	11 inches	12.1	24.1
6½ inches	6.4	12.9	12 inches	12.1	24.1
7 inches	7.6	15.3	13 inches	12.1	24.1
7½ inches	8.0	16.1	14 inches	12.1	24.1
8 inches	8.4	16.9	15 inches	12.1	24.1
8½ inches	8.4	16.9	16 inches	11.3	22.5
9 inches	9.6	19.3	17 inches	11.3	22.5
9½ inches	10.5	20.9	18 inches	10.9	21.7

The prices vary a great deal in the different districts. Where pulp mills are bidding for timber, the prices of the smaller log dimensions are usually higher in proportion. The average cost of floating to the mill in the Skelleftea district was three-fourths of 1 cent per cubic foot in 1914 and 1½ cents in 1917.

From the foregoing table it is noticeable that the value of logs increases as the top diameters increase from 5 to 11 inches; but logs 11, 12, 13, 14, and 15 inches in top diameter are quoted at the same price, while logs 16 and 17 inches in top diameter are quoted at a lower price and there is a further decrease with logs 18 inches in top diameter. This decrease in the value of the heavy logs is due to the fact that they are cut from overmature trees, which often show serious defects when sawn.

The following table shows the prices per cubic foot obtained for pine saw logs of different top diameters cut in the State forests in different districts during 1913, 1915, and 1917:

Districts.	1913				1915				1917			
	7 inches.	9 inches.	11 inches.	13 inches.	7 inches.	9 inches.	11 inches.	13 inches.	7 inches.	9 inches.	11 inches.	13 inches.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Lulea	5.6	7.5	9.6	10.2	7.5	9.1	12.9	12.9	11.3	11.3	11.3	13.1
Umea	7.2	9.4	12.3	13.1	7.8	10.7	13.4	13.4	12.6	15.8	22.8	21.4
Gevle-Dala	7.2	9.4	12.3	12.3	9.6	12.3	16.1	16.1	15.3	18.8	21.4	22.8
Vestra	10.7	12.1	13.4	13.4	10.5	12.6	14.5	14.5	21.4	24.1	26.8	.....

It is understood that the prices of saw logs have already reached their climax and that they have decreased in most of the districts in Sweden. When the prices of saw logs are high, the forest owners naturally endeavor to cut as much in their own forests as possible.

FLOATING.

No other country in the world has such favorable conditions for cheap transportation of saw logs from the forest to the mill as Sweden. The entire country is virtually honeycombed with various

water systems, which offer splendid facilities for the floating of timber. Timber has been floated for centuries in Sweden, but the floating was not regulated in the modern sense of the word until about 50 or 60 years ago.

It is difficult to ascertain with certainty at what time log floating was started in Sweden, but there are indications that it was as early as the fourteenth and fifteenth centuries, when mining was conducted on a large scale. The first governmental regulation in regard to floating was issued in 1551, and in 1674 floating on a large scale was recorded in the Dal River. Until 1809 the floating of timber had been carried on separately by individual log owners, but in that year the first floating association was established on the Klar River, which empties into Lake Wenner. The present floating system in Sweden was regulated by law in 1880.

Important improvements have been made in the Swedish rivers to make them suitable for floating; up to the outbreak of the war it was roughly estimated that at least $40,000,000 had been spent for such purposes, of which the Government had contributed approximately $600,000. Private enterprises have thus taken the most active part in this work, while the Government assistance has consisted mainly in making laws that would enable the log owner to use the rivers for floating timber without being hampered by private interests having property on the river banks.

At present, the total length of all rivers suitable for floating in Sweden is estimated at 18,600 miles. Immediately before the war, it was estimated that about 85,000,000 logs were floated in these rivers annually and of this quantity approximately 85 per cent were floated in the rivers of Norrland and Dalecarlia.

FLOATING-RIVER SYSTEMS.

The principal floating rivers in Norrland and central Sweden are designated on figure 30. There is hardly any forest region in those parts of Sweden more than 6 to 10 miles from the nearest floating river.

The rivers in northern Sweden run from the mountainous regions on the Norwegian border in a southeasterly direction, emptying into the Gulf of Bothnia. Some rivers originate in Norway, the most important being the Klar. The principal floating rivers in Sweden are found in northern and central Sweden, from the Finnish border to the mouth of the Dal River, a distance of about 470 miles.

According to an estimate made by Otto Hellström, a well-known Swedish lumber expert, the table following shows the area of productive forest regions bordering the principal Swedish floating rivers, and also the total lengths of these rivers and their tributaries suitable for floating.

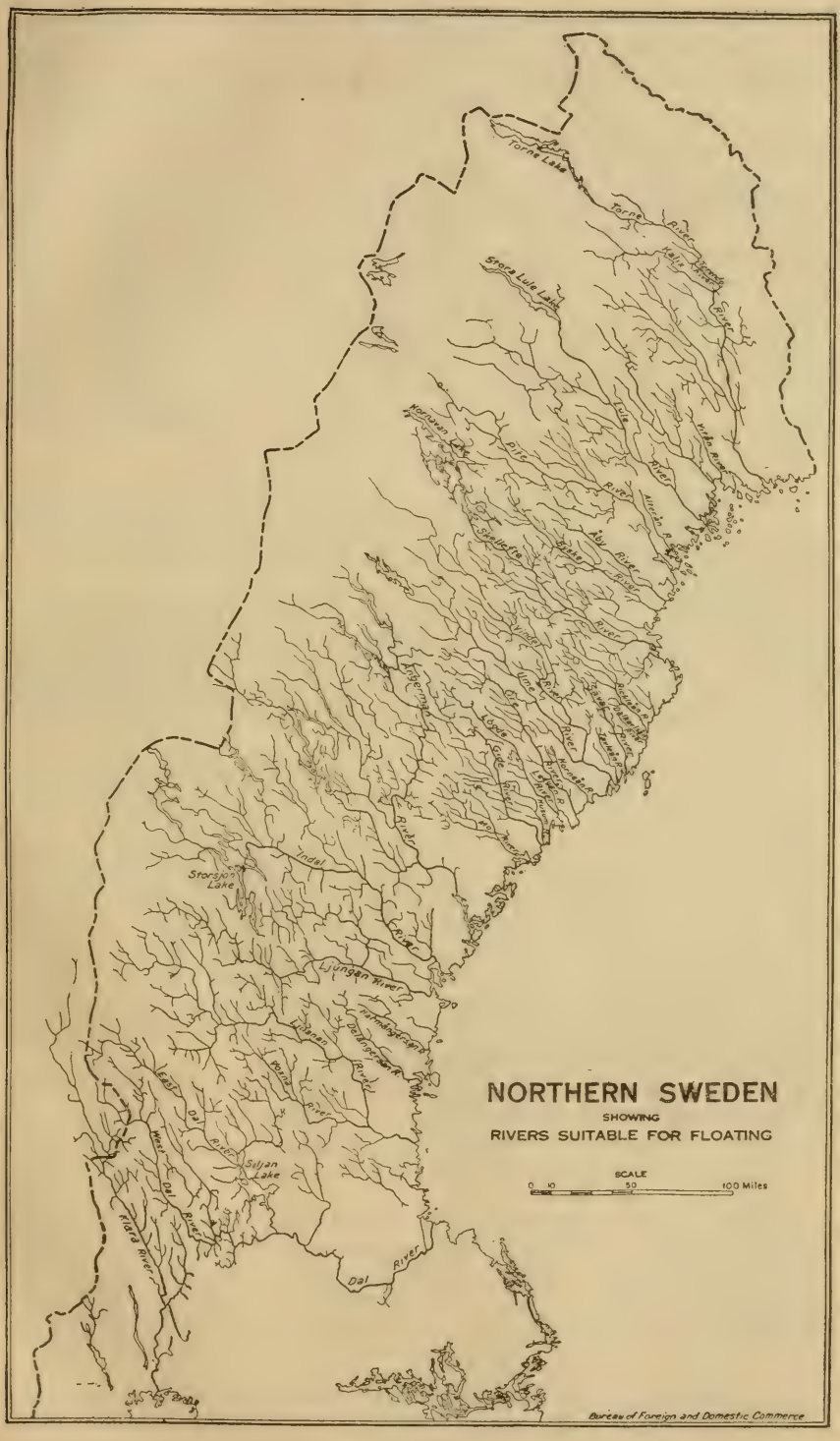

NORTHERN SWEDEN
SHOWING
RIVERS SUITABLE FOR FLOATING
SCALE
0 10 50 100 Miles
Bureau of Foreign and Domestic Commerce

FIG. 30.

Floating-river systems.	Adjacent productive forest area.	Length of floating rivers, including tributaries.	Floating-river systems.	Adjacent productive forest area.	Length of floating rivers, including tributaries.
	Acres.	*Miles.*		*Acres.*	*Miles.*
Kalix, including Upper Tornea and Tarendo	2,965,000	1,142	Ore	531,000	329
Vitan	82,000	39	Leduan	54,000	25
Ranea	667,000	326	Logde	272,000	160
Lulea	2,224,000	785	Gidea and Husum	717,000	468
Alteran	82,000	30	Mo	420,000	290
Pitea	1,359,000	616	Angermann	4,201,000	2,088
Aby	225,000	123	Indal	3,163,000	1,156
Byske	618,000	382	Ljungan	1,878,000	942
Skelleftea	1,606,000	985	Harmangersan	205,000	124
Burea	173,000	117	Delangersan	321,000	95
Ricklean	356,000	221	Ljusne	2,842,000	1,212
Dalkarlsan	54,000	32	Skerjan	64,000	12
Sevaran	173,000	148	Dal	4,670,000	1,620
Tavlean	67,000	57	Klar	1,878,000	746
Umea	3,262,000	1,101	Total	35,191,000	15,426
Hornean	62,000	55			

Some of the rivers mentioned originate in Norway and the total area of productive forests bordering them in Norwegian territory is about 692,000 acres. This figure has already been included in the estimate given in the table.

In southern Sweden the rivers are generally short and many of the waterfalls have been harnessed or the rivers otherwise utilized by industries. This utilization materially hampers the facilities for the floating of logs. Practically the only important floating-river system running through southern Sweden is that of the Klar and Gota Rivers.

Southern Sweden can be left out of consideration almost entirely, because floating is carried on there in an inefficient way and on a small scale.

In Norrland, north of the Dal River, there are about 60 floating rivers of any importance, all emptying into the Gulf of Bothnia. Of these rivers, 11 are more than 185 miles in length, 9 are 60 to 125 miles, 17 are 30 to 60 miles, and 24 are less than 30 miles. It is of great importance to the floating in northern Sweden that the rivers run parallel without joining in the lower course. If they came together there would be a terrific jam of logs at this part of the river during the floating season. The descent, usually 5 to 11 feet per mile, is very suitable for floating purposes.

The following table shows the length and the fall per mile of some of the principal rivers in Sweden:

Rivers.	Length.	Fall per mile.	Rivers.	Length.	Fall per mile.
	Miles.	*Feet.*		*Miles.*	*Feet.*
Tornea River	233	4.9	Angermann	242	8.2
Kalix	208	7.9	Indal	196	8.5
Lulea	193	9.8	Ljungan	168	11.1
Pitea	191	11.1	Ljusne	230	9.0
Skelleftea	205	7.9	East Dal	283	5.5
Umea	237	6.6	Klar	228	4.8

Comparing the fall in the Swedish rivers with that of the rivers, for instance, in northern Russia and other parts of Europe, it is evident

that Swedish rivers have a great advantage, because the fall is sufficient to carry the logs without any mechanical assistance. In many other countries it is necessary to tow the logs for hundreds of miles at great expense.

The percentage of lakes in the Swedish floating systems varies between 3.4 and 12.7 per cent. The lakes have a beneficial influence on the floating operations, because they act as reservoirs for the water in the spring, thereby insuring a more evenly distributed supply. Furthermore, these lakes afford excellent facilities for storing logs. The same good conditions for log storage are found at the mouths of the rivers that enter the Gulf of Bothnia, because the tide is not strong enough to cause any disturbance.

It is fortunate that in northern Sweden the harnessing of waterfalls has not been taken up before the rivers were regulated for floating. At present this harnessing of waterfalls can be done with due regard to floating conditions.

The river beds of the northern Swedish rivers are deep and the banks are generally high. Thus inundations do not occur frequently—a fortunate condition for the lumberman, as such floods are liable to scatter the logs and cause considerable damage.

In the rivers in northern Sweden the water stand is at its maximum during the spring and summer, while in southern Sweden the water stand is at its lowest during the summer. For this reason the Swedish rivers in the north are of better service in floating logs than in southern Sweden, since logging operations are carried on during the winter and the logs are floated during the spring and summer. The floating in northern Sweden can be carried on from the time the Gulf of Bothnia is free from ice, which is generally at the middle or end of May, until the beginning or middle of November. The ice generally covers the rivers 150 to 200 days during the year; it melts first at the mouth and later toward the source. This is of the greatest importance, because thus the lower course of the river is the first to be clear of obstructions, so that log jams are avoided.

The same conditions apply in Norway, but few other European countries have the same favorable floating conditions.

ORGANIZATION OF FLOATING.

The floating in northern Sweden particularly is regulated in a very efficient way. About half a century ago each mill floated its own logs independently of other mills, but this system was very expensive, as comparatively few improvements could be made in the rivers by each individual company. A change in this system was effected a few decades ago, and the present system of floating is based on the close cooperation of the mills having saw logs to be floated in the same rivers.

The Swedish laws governing the waterways provide that if log owners deem it necessary they can have any river declared by the Government as open to public floating; but in order to take this step, it is necessary to prove that the river will be of public use and that the cost of improvements will not be so excessive that the importance of the river for floating would be materially reduced. Only after the Government has declared the river to be opened as a public floating river can the owners of the land on both sides of the river be forced

to consent to have logs floated through their property. According to Swedish laws, the landowner on the bank of a river owns part of the river adjacent to his property.

Before the river is open to public use, all accounts, plans, and estimates for the proposed operation of the floating river must be approved and verified by the Government. Very strict regulations govern the division of the expenses for improvements, etc., between the interested parties. On the capital invested in improvements of the rivers, etc., it is allowed to charge from 5 to 10 per cent interest, including a certain percentage of risk. As a rule, the operation of a floating river is too risky and too large an undertaking for any one individual and it is therefore undertaken by an association formed of all the log owners having logs to be floated in the same river. If the logs floated during any one year should be less than the estimate made in advance, the money paid in beforehand for the improvements, the upkeep, and the operation of the floating river is not returned. This risk is supposed to be covered by the 5 to 10 per cent charge for interest and risk, which represents the only possible profit derived from the money invested. The accounts are carefully audited by Government officials. The charges for depreciation must not extend through more than 20 years, and as soon as the improvements have been amortized no charges of any kind can be made for the use of the river, but those who use the river for floating must keep up the improvements, effect the necessary repairs, etc.

The members of the floating association are jointly responsible for damage done to property by the logs in floating. In order to divide the cost of floating equally among the members, the rivers are divided into a great many districts, each of which has a special tariff per log.

It is very interesting to consider the difference between the operation of a floating-river association and that of any other transportation company, because the profit derived from the operation of the floating river is returned directly to the members of the association, and no dividends are paid except legitimate charges for interest and risk such as are allowed by law.

It has been the intention of the Government to regulate the cost of floating in such a way that it would be of real benefit to the public and not a means of making money. In other words, the floating rivers are considered so essential to the welfare of the nation that they are classed with other means of transportation and communication, such as State railroads, telegraph and telephone, and mail.

There are at present about 270 floating associations in Sweden, of which 25 or 30 are important. There are about half a dozen small floating associations in southern Sweden, but none of any consequence. The floating is sometimes undertaken by different associations for the main river and for the tributary rivers, and it is difficult for all the associations in the same river system to cooperate in floating. It must be borne in mind that at times floating must be rushed during the few weeks of the spring flood, and if there is a lack of cooperation in the floating of timber between the different districts, the result is often a mix-up of logs and the formation of log jams. The tendency is for the larger associations to absorb the smaller associations in the tributary rivers. Of all the floating in Sweden more than 70 per cent is effected by associations. The balance is carried on by private individuals, mainly on tributary rivers.

IMPROVEMENT OF FLOATING RIVERS.

It is evident that if the rivers can be improved to make them better suited for floating, the time required for floating logs will be materially reduced. Furthermore, the labor charges for floating will be decreased and also the percentage of sunken logs. On account of the excellent improvements in the Swedish rivers, the floating seldom extends during more than one season. Only in rare cases, when the logs are taken from districts close to the Norwegian border, may it require two years to bring them down to the shore of the Gulf of Bothnia.

The percentage of sunken logs varies greatly in the different rivers. It may be said to be ½ per cent to 1½ per cent in well-regulated rivers, and occasionally 2 or 2½ per cent. The importance of limiting the floating to one year is seen from the fact that two-year floating increases the percentage of sunken logs about 100 per cent. Furthermore, the logs are often greatly damaged during a two-year logging period. A considerable loss of interest must also be charged to the logs during the two years of floating. All told, it is estimated that two-year floating represents a loss to the log owner of at least 20 to 25 per cent of the log value. The expenses for improvements, therefore, must be considered a very good investment on account of the decreased time required for floating.

These improvements generally consist of dams with which to regulate the water, and walls of logs, stone, or concrete. Stones and other obstacles must be blasted and many booms laid out in various parts of the river to prevent the logs from taking a wrong course.

PROCESS OF FLOATING.

The floating generally starts in May and ends in October or November. The logs piled on the banks of the rivers are dumped into the water as soon as the ice melts. The cost of this work is charged direct to each log owner.

The floating river is divided into districts of 7 to 14 miles each, and the floating is generally given out on contract, with strict stipulations in regard to the time when the floating should finish and also with provisions for fines to be paid by the contractor for logs that are left over, etc. The floating must be well organized and the floating crews in the various districts must cooperate with one another.

The spring flood starts first and lasts only a few weeks. Quick action must be taken to have the logs moved during this time and every effort is made to economize water by retaining the water supply in the dams to the greatest possible extent. The different districts are connected with telephone so that the dam keepers can let out the water when necessary.

The flood in the mountainous districts starts generally about two to three weeks after the spring flood is over. This second flood is of great importance to Sweden, but it is seldom found in other countries except Norway and in two rivers in Finland. It is on account of these two floods that floating can generally be accomplished during one season in Sweden.

The logs frequently jam in the rivers and it may be necessary to use dynamite in order to loosen them. The logs are generally floated individually. Across lakes they are bunched in ring booms, consisting of about 100 boom sticks and capable of holding 15,000 to 20,000 logs. These ring booms are towed across the lakes, either by small steamboats or by stationary electric motors on the shore.

In the Tornea River, on the Finnish border, logs must be bunched and tied with chains, and similar regulations apply to the canals.

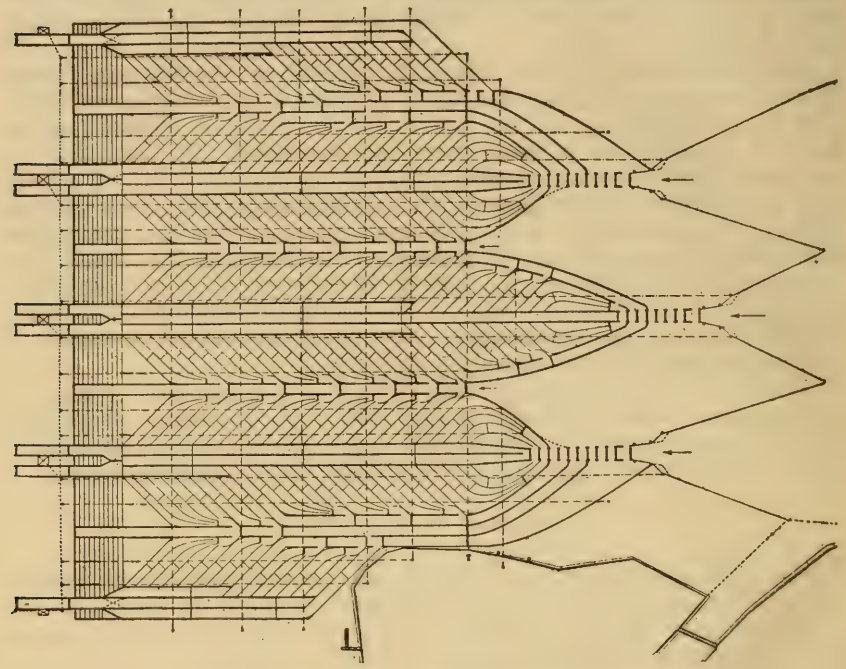


FIG. 31.—Plan of sorting basin for saw logs at Sandslan.

The average speed of the logs in the rivers is about 75 miles per month. As was mentioned previously, long lengths can not be floated in Swedish rivers without difficulty; but recent improvements have made it easier to float long lengths. Years ago, in many of the Swedish rivers, the maximum log length was only 14 feet, and this may explain the demand in some countries for 14-foot lumber.

SORTING OF LOGS.

In the lower course of the rivers the logs must be sorted according to ownership, and for this purpose a suitable location is selected where an arrangement for sorting is constructed. These sorting devices may vary considerably in construction. The best device is found in the sorting basin of Sandslan, in the Angermann River. This sorting basin, laid out according to a Norwegian system (Blakstad system), can sort 120,000 logs in 10 hours. Up to 90 different log owners may have their logs sorted at one time. In the basin 310 men per shift are employed and more than 12,000,000 logs are sorted per year.

FIG. 32.—BUNDLING SMALL TOP LOGS FOR FLOATING.

Courtesy of Forester O. Eneroth.

FIG. 33.—PULP LOGS AND LOGS FOR BOX FACTORIES PILED ON RIVER BANK.

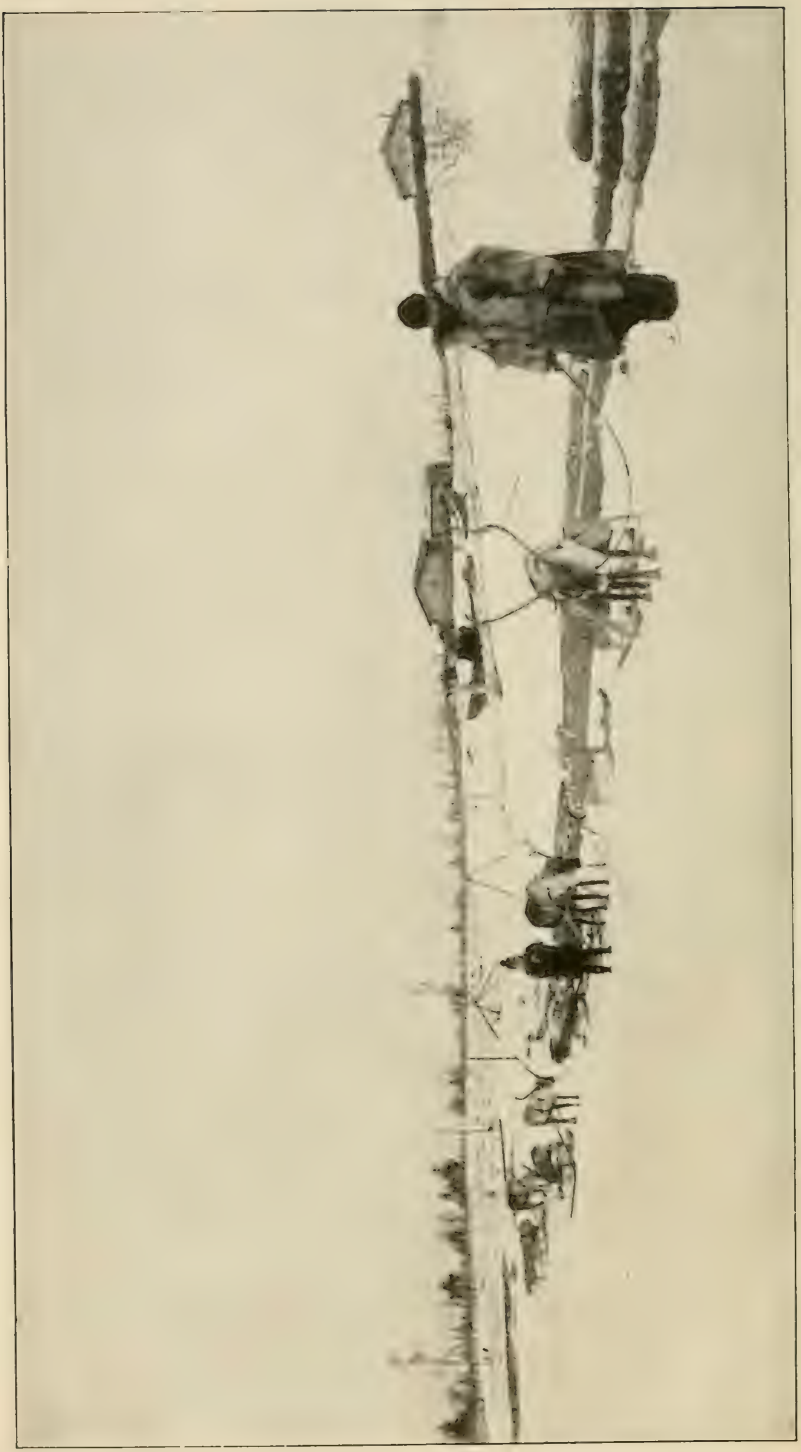


FIG. 34.—LOGGING WITH REINDEER, NORTHERN SWEDEN.

After the logs have been sorted according to ownership, they are bundled and tied with wire. At times they are made into small rafts. There are 130 to 200 logs per bundle, and by means of a clever mechanical device, 16 men can put up 6 bundles per hour. From the sorting basin the logs are towed to the mills.

After the logging season is over a final inspection is made of the entire floating river in order to clean up possible left-over logs and to settle the question of damage to private property caused by logs during the floating season.

In a few districts in southern Norrland logging is interrupted during part of the summer on account of the salmon fishing, which is going on at that time. Some of the mills in these districts must therefore take their logs to the mills by rail, which entails a large expenditure. For this purpose a few companies have constructed their own railroads.

Recently in Sweden a new machine has been put on the market for salvaging sunken logs. It consists of a crane mounted on a barge and provided with an axle that has two claws. These claws may be lowered into the water, and when they reach the bottom the points of the claws are about 13 feet apart. As the claws are pulled up they grab the logs lying between their points. The machine is driven by motor power and is estimated to salvage 100 to 200 logs per day.

OCEAN RAFTING OF LOGS.

Besides the river floating, millions of logs are rafted every year up and down the coast and even from Finland across the Gulf of Bothnia. The Finnish logs are usually rafted in entire tree lengths, and the rafts are made up in cigar-shaped forms or placed in frames containing 600 to 800 logs. About 15 of these rafts are connected with chains and towed by steamer to their destination.

It has been reported that even mills south of Stockholm have taken logs from northern Finland, but this may be rather unusual. The rafting of Finnish logs is generally limited to central and northern Norrland. During the latter part of the war the rafting of logs from Finland decreased to some extent.

The various districts along the coast in Norrland take large quantities of logs from adjacent districts.

LABOR AND WAGES.

It is estimated that 30,000 to 35,000 men are employed annually in floating logs. The Swedish floaters are skilled workers but their work is both dangerous and difficult. The men must often pass the night on the frozen ground, but during late years, the floating associations have endeavored to provide adequate housing accommodations.

The work is generally done on a contract basis, but when wages are paid they have been about $1.05 in 1913 for ordinary floating work and $1.18 for sorting logs. During 1918 from $4 to $6.50 was usually paid for floating and sorting.

QUANTITIES OF LOGS FLOATED.

No official figures are available as to the number of logs floated, but comprehensive statistics have been compiled by Otto Hellström.

The following table shows the number of logs floated in 1912 and the average for 1908–1912 on the Klar River and the floating-river systems of northern Sweden:

Floating-river systems.	1912	Average 1908–1912.	Floating-river systems.	1912	Average 1908–1912.
Kalix, including Torneå and Tarendo Rivers	1,100,000	860,000	Ore	692,000	687,000
Vitan	64,000	60,000	Leduan	102,000	42,000
Ranea	415,000	350,000	Logde	373,000	360,000
Lulea	644,000	516,000	Gidea and Husum	2,081,000	1,718,000
Alteran	157,000	139,000	Mo	2,282,000	2,282,000
Pitea	632,000	600,000	Angermann	10,832,000	9,780,000
Aby	319,000	180,000	Indal	6,950,000	5,131,000
Byske	578,000	607,000	Ljungan	7,046,000	5,082,000
Skelleftea	2,442,000	2,440,000	Harmangersan	2,187,000	1,372,000
Burea	609,000	412,000	Delangersan	1,603,000	884,000
Ricklean	817,000	806,000	Ljusne	9,289,000	9,269,000
Dalkarlsan	83,000	60,000	Skerjan	175,000	91,000
Sevaran	785,000	604,000	Dal	18,000,000	14,400,000
Tavlean	158,000	112,000	Klar	4,700,000	4,711,000
Umea	2,237,000	2,094,000	Total	77,711,000	65,937,000
Hornean	359,000	288,000			

Besides the logs floated in the districts specified, it may be safe to assume that 3,000,000 to 4,000,000 logs are floated in southern Sweden.

Since 1912, the quantities of logs floated have increased considerably, and at present it is believed that approximately 85,000,000 logs are floated in all Swedish rivers. The quantity is estimated at approximately 394,000,000 cubic feet. It must be borne in mind, however, that pulp logs are included in these figures.

The most important floating river in Sweden is the Angermann River. The quantities of logs floated in this river during the years 1915, 1916, and 1917 were as follows: 1915—9,820,930 logs containing 49,367,817 cubic feet; 1916—12,667,593 logs containing 60,826,169 cubic feet; 1917—13,589,199 logs containing 60,277,914 cubic feet.

The average distance of floating in Sweden is estimated at 125 miles.

COST OF FLOATING.

Immediately before the war it was estimated by Otto Hellström that the average cost of floating logs a distance of 125 miles was approximately 0.635 cent per cubic foot. This charge also included sorting at the mouth of the river. It is almost impossible to give such a detailed statement of the floating cost in the different districts because the cost of floating is based on different standards in nearly all districts. In some districts the cost of floating is based on the cubic foot and other districts on the log, and in the latter case the tariff is regulated according to log lengths. In some districts there may be extra charges for lengths more than 20 feet and up. Other districts may be able to float such long lengths at a lower cost for the same distance. Furthermore, the cost of floating is dependent largely upon the expenditure made for improving the floating river and on previous depreciation charges on improvements. In the best-regulated floating rivers, which have been in operation for decades, the depreciation charges may be almost negligible.

The accompanying diagram, prepared by Axel Löf, a well-known Swedish expert on floating, shows how the log dimensions affect the cost of floating and refers to conditions in the Dal River.

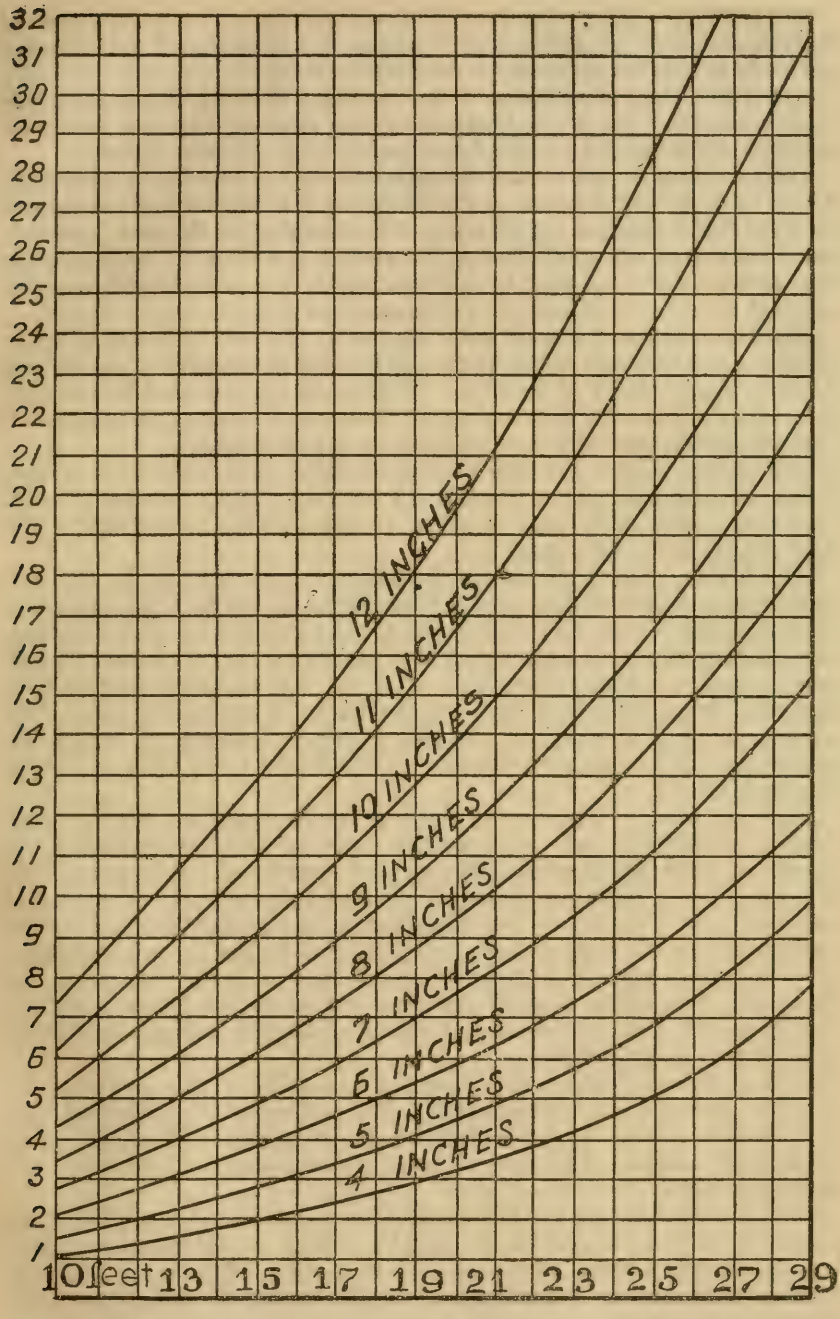


FIG. 35.—Relative cost of floating various log dimensions, shown by index numbers.

Generally speaking, the cost of floating is highest for the rivers of Norrbotten and Vesterbotten, because the number of logs floated per mile is smaller than in rivers farther south.

According to information from various floating river districts, some examples are given illustrating the floating charges and their increase after the war started compared with pre-war figures.

It appears that the cost of floating before the war has varied from 0.423 cent to 1.715 cents per cubic foot for the average distance, Besides these charges for floating, the dumping of the saw logs into the rivers was charged directly to each log owner. These charges amounted before the war to approximately 0.4 cent to 0.6 cent per log and in 1917, to 0.8 cent to 1.3 cents per log.

The following statements with regard to the cost of floating in the different districts are taken from the reports of some of the principal floating associations in Sweden. The material collected has merely the object of showing the increase in the cost of floating during recent years and also how the cost of floating is calculated.

Klar River.—The average cost of floating per cubic foot was as follows in the Klar River from 1913 to 1919: 1913, 0.49 cent; 1914, 0.52 cent; 1915, 0.54 cent; 1916, 0.81 cent; 1917, 1.09 cents; 1918, 1.24 cents; 1919, 1.24 cents.

Dal River.—The basis of the floating charges for logs in the Dal River is as follows: Up to 9.8 feet long, equal to one-fifth of a standard log; 9.8 to 13.1 feet long, equal to one-third of a standard log; 13.1 to 29.5 feet long equal to 1 standard log; 29.5 to 42.7 feet long, equal to 1½ standard logs; 42.7 to 59.0 feet long, equal to 4 standard logs; 59.0 feet and up, equal to 8 standard logs. The average cost of floating in the Dal River, a distance of about 125 miles, was 1.072 cents per cubic foot in 1913 and 1.876 cents per cubic foot in 1917–18.

Ljungan River.—The cost of floating is calculated on the following basis: For logs 21 feet and shorter and less than 5 inches in top diameter, 0.35 standard log; 21 feet and shorter and 5 to 8 inches in top diameter, 0.50 standard log; 21 to and including 27 feet in length and less than 5 inches in top diameter, 0.50 standard log; 21 feet to and including 27 feet in length and 5 to 8 inches in top diameter, 0.70 standard log; 27 feet and shorter and 8 to 11 inches in top diameter, 1 standard log; 27 feet and up to 40 feet, irrespective of top diameter, 3 standard logs; 40 feet and longer, irrespective of top diameter, 6 standard logs.

Ljusne River.—The charges from Lossen Lake to the mouth of the river, a distance of approximately 218 miles, were as follows, per standard log: 1913, 11.6 cents; 1914, 16.10 cents; 1915, 17.77 cents; 1916, 27.60 cents. The cost of sorting amounted to 0.748 to 3.055 cents per log.

The floating charges in the Ljusne River are based on the following schedule: Logs up to and including 24 feet long, equal to one standard log; log lengths from 25 up to and including 27 feet, 25 per cent increase; log lengths from 28 up to and including 31 feet, 50 per cent increase; log lengths from 32 up to and including 34 feet, 75 per cent increase; log lengths from 35 up to and including 37 feet, 100 per cent increase; log lengths from 38 up to and including 40 feet, 200 per cent increase; log lengths from 41 feet up, 400 per cent increase. Ninety-five per cent of all logs floated in this river are less than 25 feet long.

Indal River.—The average cost of floating in the Indal River was given at approximately 6.7 cents per standard log during the last 30 years. The average log dimensions decreased from 19 feet, with a top diameter of 10 inches, in 1888 to 19 feet, with a top diameter of 7 inches, in 1917.

Angermann River.—In the Angermann River for log lengths of 27½ to 35 feet there is 100 per cent increase over the shorter lengths in the cost of floating; for log lengths 35 to 40 feet, an increase of 150 per cent; and for log lengths of 40 to 45 feet, an increase of 200 per cent. The average cost of floating per cubic foot in this river has been as follows:

Years.	Floating.	Sorting.	Total, floating and sorting.	Years.	Floating.	Sorting.	Total, floating and sorting.
	Cents.	*Cents.*	*Cents.*		*Cents.*	*Cents.*	*Cents.*
1913	0.335	0.268	0.603	1916	0.474	0.289	0.763
1914	.394	.311	.705	1917	.686	.490	1.176
1915	.316	.176	.492	1918	1.332	.957	2.289

In 1914, 10,588,348 logs were floated in this river, of which only 630 logs were longer than 27½ feet.

Umea River.—The cost of floating in the Umea River was approximately 20.10 cents per log in 1915 and 21.17 cents in 1916, covering the longest distance in this river, which is approximately 240 miles. The cost of sorting logs was on an average 0.9 cent per log and was based on the following schedule: Logs 55 feet and up, equal to 8 standard logs; logs 45 to 55 feet, equal to 5 standard logs; logs 35 to 45 feet, equal to 3 standard logs; logs 27 to 35 feet, equal to 2 standard logs; logs 14 to 27 feet, equal to 1 standard log; logs 14 feet and less, equal to one-half standard log.

Skelleftea River.—The average cost of floating on the Skelleftea River was as follows: 1913, 0.74 cent per cubic foot; 1914, 0.81 cent per cubic foot; 1915, 0.80 cent per cubic foot; 1916, 1.04 cents per cubic foot; 1917, 1.12 cents per cubic foot.

The maximum cost of floating from the most remote point of this river to the mouth of the river, a distance of approximately 190 miles, amounted to 3.26 cents per cubic foot in 1917 and the sorting of logs amounted to 0.38 cent per cubic foot.

The cost of floating is based on the following schedule: Logs 24 to 27 feet, 50 per cent increase above shorter lengths; logs 28 to 33 feet, 100 per cent increase above lengths shorter than 24 feet; logs 33 feet and up, 300 per cent increase above lengths shorter than 24 feet.

Pitea River.—The cost of floating in the Pitea River was on an average 13.4 cents per log in 1917. Log lengths in excess of 27 feet are counted as two standard logs, and no logs longer than 30 feet can be floated.

Ranea River.—The charges for floating for the maximum distance (District No. 4) to the mouth of the Ranea River was as follows from 1913 to 1917: 1913, 1.61 cents per cubic foot; 1914, 1.68 cents per cubic foot; 1915, 1.80 cents per cubic foot; 1916, 1.63 cents per cubic foot; 1917, 1.89 cents per cubic foot.

Lulea River.—The charges for floating in Districts Nos. 9 and 10 on the Lulea River were as follows: 1913, 0.96 cent per cubic foot;

1914, 0.90 cent per cubic foot; 1915, 1.63 cents per cubic foot; 1916, 1.41 cents per cubic foot; 1917, 1.70 cents per cubic foot.

Kalix River.—The cost of floating in the tenth district in the lower course of the Kalix River was as follows from 1913 to 1917: 1913, 0.44 cent per cubic foot; 1914, 0.43 cent per cubic foot; 1915, 0.44 cent per cubic foot; 1916, 0.51 cent per cubic foot; 1917, 0.89 cent per cubic foot.

The cost of floating in Finland and of rafting logs to northern Sweden was approximately 3.2 cents per cubic foot in 1913 and 4 cents in 19

It may be stated as a general rule that of the total cost of transportation from river bank in the forest to the mills, the cost of floating itself is about 70 per cent and the cost of sorting about 30 per cent.

The following table, prepared by Otto Hellström, shows the average cost of floating on the different river systems of Sweden for the period 1908 to 1912:

Floating-river systems.	Average cost of floating, 1908–1912.		Log content.	Floating-river systems.	Average cost of floating, 1908–1912.		Log content.
	Per log.	Per cubic foot.			Per log.	Per cubic foot.	
Kalix, including Upper Tornea and Tarendo Rivers	*Cents.* 8.85	*Cents.* 1.14	*Cubic feet.* 7.8	Hornean	*Cents.* 1.92	*Cents.* 0.96	*Cubic feet.* 2.0
Vitan	3.24	.81	4.0	Ore	2.60	.....	.....
Ranea	5.97	.99	6.0	Leduan	5.17	.85	6.1
Lulea	5.38	.80	6.7	Logde	7.03	1.72	4.1
Alteran	2.25	.47	4.8	Gidea and Husum	3.14	.57	5.5
Pitea	7.55	.....	.....	Mo	2.46	.....	.....
Aby	4.44	.....	.....	Angermann	3.35	.....	.....
Byske	5.92	.93	6.4	Indal	6.40	.....	.....
Skelleftea	3.67	.....	.....	Ljungan	2.50	.....	.....
Burea	3.70	.91	4.1	Harmangersan	1.54	.....	.....
Ricklean	1.82	.57	3.2	Delangersan	1.91	.....	.....
Dalkarlsan	3.20	1.03	3.1	Ljusne	2.21	.....	.....
Sevaran	2.62	.42	6.2	Skerjan	2.44	.....	.....
Tavlean	3.48	.....	.....	Dal	2.73	.76	3.6
Umea	6.53	.....	.....	Klar	2.27	.57	4.0
				Average	3.46	.77	.....

The cost of floating has generally been reduced during the last half century in most of the rivers in Sweden, in spite of the fact that wages have gone up to a very large extent. The decrease was due to the improvements made on the floating rivers. Besides this decreased cost of floating, which directly benefits the log owners, the improvements also opened up large areas of forest land and made them accessible to exploitation, thereby increasing the value of stumpage.

The following figures are given by Forester Ekman covering the cost of floating per standard log in the Ljusne River, a distance of about 150 miles from Lofsan to Lake Marmen, from 1865 to 1905: 1865, 4.3 cents; 1870, 2.9 cents; 1875, 3.5 cents; 1880, 3.1 cents; 1885, 2.1 cents; 1890, 1.7 cents; 1895, 1.4 cents; 1900, 1.3 cents: 1905, 1.2 cents. The corresponding figures for 1910 and 1913, according to the reports of the Floating Association, are 4 cents and 2.7 cents, respectively.

EFFECT OF FLOATING ON QUALITY.

The timber must be materially affected by remaining in the water one or two years during the floating. The gum in the logs is partly washed out and the wood is made softer. Consequently the lasting qualities are somewhat decreased, but on the other hand the color of the wood becomes more uniform.

It is also found that lumber cut from floated timber is less liable to shrink during the process of seasoning and shows less tendency to split, crack, or warp. It is also claimed that lumber of this kind is less liable to discolor during the seasoning process than lumber cut from logs that have not been in contact with water. However, during the process of floating, particularly during two years of floating, the sapwood of the logs may discolor and this is a serious drawback.

The opinions in the different importing countries vary considerably in regard to the merits of lumber cut from floated timber. Germany and Denmark, for instance, both of which have been accustomed to receive large quantities of lumber cut from unfloated timber, always prefer such stock, while most of the other markets prefer the other kind.

The drawbacks, if any, appear to be too small to offset the advantages of this cheap transportation facility.

FUTURE DEVELOPMENTS.

In the future, one may look forward to increased activities in improvement of the waterways in Sweden to make them suitable for floating, particularly in the northernmost Provinces. The Swedish forest owners will thus be enabled to utilize to better advantage the waste products in the forests and the small-dimension logs.

Furthermore, it is expected that when the many waterfalls have been harnessed, a more systematic economizing of the water will be imperative during the floating period. In this regard, the Swedish floating interests have much to learn from Norway.

Although stumpage values will probably remain at a very high figure in the future, the cheap transportation of the saw logs will always enable the Swedish lumbermen to obtain the raw material delivered at the mills at a figure that will make possible competition in European markets with any other country.

The cost of floating will probably decrease as soon as the many improvements in the waterways have been amortized.

PART II.—LUMBER MANUFACTURE.

SAWMILL INDUSTRY.

DEVELOPMENT OF THE INDUSTRY.

The sawmill industry has old traditions in Sweden and dates back several hundred years. The first mills were constructed in southern Sweden at the beginning of the sixteenth century. They were of primitive construction and operated by water power. The gang saws had only one saw blade inserted in the sash, and the kerf was frequently as heavy as one-half inch. The first improvement in the mill equipment was made at the end of the sixteenth century, when Dutch sawmill machinery was introduced. The Dutch gang saws were equipped with thinner saw blades and had several blades inserted in the sash.

One of the first mills in Norrland was constructed in 1744 at Kramfors. Prior to the middle of the last century, the sawmill industry, basing its production on export, was concentrated mainly on the southwestern coast of Sweden and in the Province of Vermland. But the mills were of small capacity, and the industry was conducted on a small scale, compared with the present sawmill industry in Sweden. These mills frequently operated with unsatisfactory results, and it was not until the sawmill owners formed larger corporations that the industry started to grow to any great extent.

The first sawmill company in Sweden was established in 1855 (Korsnas Sagverks A/B.) at Gevle, in southern Norrland. The first steam sawmill in Sweden was constructed in 1851 at Wifsta in central Norrland, near the port of Sundsvall. This sawmill was operated in connection with a shipbuilding plant, and the wooden vessels turned out by this company were loaded with lumber, and both ships and cargoes were sold abroad.

The heavy British import duty on lumber was a handicap to the Swedish sawmills, but in 1866, these import duties were abolished and the demand for Swedish lumber increased materially from that time. As a consequence of these conditions, many new sawmills were constructed in Sweden, and the lumber industry soon developed to large proportions. The majority of the present Swedish sawmills were constructed about 40 or 50 years ago, but the owners have modernized their equipment. The first sawmill operated by electricity was built at Kramfors, in central Norrland, in 1897. To-day Sweden unquestionably stands as the leader of the world in efficient methods of manufacturing lumber and close utilization of sawmill waste.

The latest statistics available (1916) give the total number of sawmills and planing mills combined at 1,365, employing 46,864 hands. This number, however, refers only to mills working on a commercial basis. Besides this number, there are at least three or four thousand small mills, many of which are portable and scattered all over the

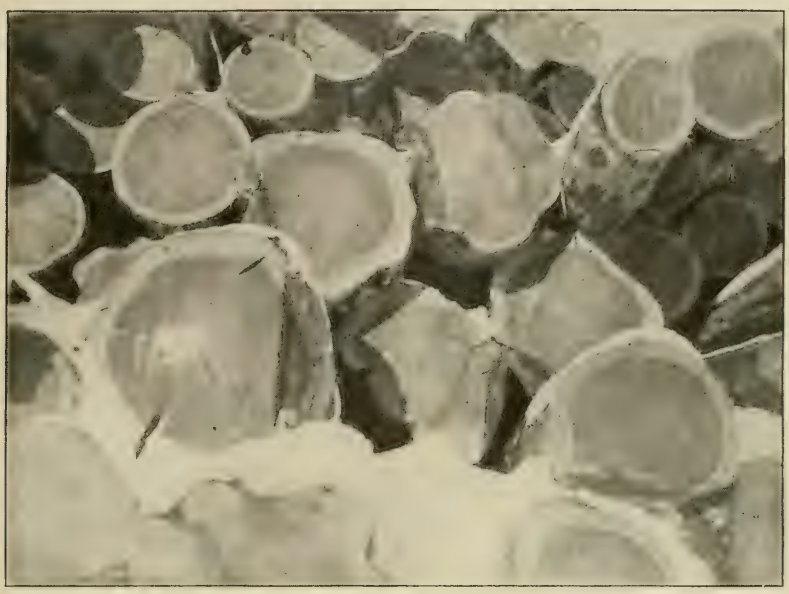


FIG. 36.—LOGS FROM STATE FORESTS, SHOWING LARGE PERCENTAGE OF HEART.

FIG. 37.—LOG JAM.

Courtesy of State Forest Laboratory, Stockholm.

FIG. 38.—FLUME.

FIG. 39.—FLOATING LOGS IN NORRLAND.

southern and central parts of the country. Their operations are limited mainly to supplying the local demands, in some cases only the needs of the property where they are located. Their importance to the lumber export trade is almost insignificant.

The horsepower used by the larger mills in 1915 is given as 116,623, applied direct to the machines in the mills, and 18,049 for operating electric motors. The number of gang saws is given as 1,641 and the number of planers as 963.

The value of the production of lumber of different kinds in 1914 and 1915 was as follows:

Items.	1914	1915
Pine and spruce:		
Sawn planks, battens, and boards	$41,200,000	$49,900,000
Planed boards	11,100,000	9,800,000
Small-dimension lumber, including box shooks, planed and rough	6,000,000	8,700,000
Other lumber	300,000	400,000
Wages for sawing and planing	400,000	300,000
Total	59,000,000	69,100,000

The following table shows the development of the Swedish sawmill and planing-mill industry from 1896 to 1915:

Years.	Number of mills.	Number of hands employed.[a]	Hands per mill.	Value of production.	Horsepower applied direct to machines.		
					Total.	Per mill.	Per laborer.
1896	992	36,797	37	$33,600,000	37,126	37	1.0
1897	981	40,225	41	39,200,000	40,472	41	1.0
1898	1,019	40,683	40	38,200,000	44,292	43	1.0
1899	1,066	40,865	38	37,400,000	46,678	44	1.1
1900	1,148	43,312	38	43,800,000	51,526	45	1.2
1901	1,175	42,407	36	37,200,000	54,215	46	1.3
1902	1,122	40,581	36	37,700,000	53,000	47	1.3
1903	1,259	42,831	34	45,500,000	59,080	47	1.4
1904	1,370	41,849	31	41,100,000	64,363	47	1.5
1905	1,281	38,568	30	36,300,000	64,589	50	1.7
1906	1,377	40,347	29	43,500,000	75,843	55	1.9
1907	1,400	40,912	29	46,300,000	82,772	59	2.0
1908	1,222	36,940	30	37,600,000	82,097	67	2.2
1909	1,200	35,576	30	35,100,000	84,196	70	2.4
1910	1,232	39,605	32	48,900,000	95,994	78	2.4
1911	1,275	39,603	31	47,400,000	101,009	79	2.6
1912	1,248	37,908	30	46,700,000	99,816	80	2.7
1913	1,053	44,150	42	60,900,000	106,706	101	2.4
1914	1,101	[b]41,847	38	59,000,000	113,058	103	2.7
1915	1,132	[b]41,161	36	69,100,000	116,623	103	2.8

[a] Average for year.
[b] Of the total number, 1,847 hands were employed in the manufacture of charcoal.

It is interesting to notice how, with the development of Swedish mills, the tendency has been to increase the horsepower per laborer; in other words, how machines have been used lately for purposes for which hand labor was employed formerly.

LOCATION OF MILLS.

The location of the Swedish saw and planing mills in 1915 is shown in the following table:

Provinces.	Number of mills.	Number of hands.	Provinces.	Number of mills.	Number of hands.
City of Stockholm	6	240	Skaraborg	34	487
Stockholm, rural districts	40	661	Vermland	68	2,378
Upsala	27	938	Orebro	56	1,343
Sodermanland	42	1,086	Vestmanland	68	1,369
Ostergotland	88	1,485	Kopparberg	79	3,337
Jonkoping	76	848	Gevleborg	96	5,672
Kronoberg	74	1,411	Vesternorrland	94	8,887
Kalmar	40	858	Jemtland	32	981
Gotland	2	30	Vesterbotten	29	3,004
Blekinge	19	211	Norrbotten	31	3,004
Christianstad	27	297			
Malmohus	13	182	Total	1,132	[a]41,882
Halland	10	118	In towns	102	5,020
Goteborg and Bohus	19	2,132	In country	1,030	36,862
Elfsborg	62	923			

[a] Number employed at time statistics were taken. The average number employed during 1915 was 41,161.

The following table shows the quantity and value of the pine and spruce lumber produced by the Swedish sawmills and planing mills in the different Provinces in 1915, together with the total quantity and value for 1914:

Provinces.	M feet.[a]	Value.[a]	Provinces.	M feet.[a]	Value.[a]
City of Stockholm	12,405	$286,000	Elfsborg	31,092	714,000
Stockholm, rural districts	35,872	661,000	Skaraborg	26,976	568,000
Upsala	77,314	1,703,000	Vermland	171,635	4,067,000
Sodermanland	60,362	1,392,000	Orebro	75,115	1,523,000
Ostergotland	76,127	1,562,000	Vestmanland	55,736	1,129,000
Jonkoping	46,804	1,074,000	Kopparberg	203,015	3,970,000
Kronoberg	58,331	1,253,000	Gevleborg	365,698	7,687,000
Kalmar	45,835	1,146,000	Vesternorrland	696,507	14,782,000
Gotland	884	25,000	Jemtland	50,783	1,039,000
Blekinge	9,553	194,000	Vesterbotten	224,101	4,569,000
Christianstad	11,075	285,000	Norrbotten	215,340	4,248,000
Malmohus	6,662	232,000			
Halland	7,598	198,000	Total, 1915	2,709,147	59,651,000
Goteborg and Bohus	144,327	5,344,000	Total, 1914	2,611,155	49,914,000

[a] Special stock (lath wood) is not included in the quantities produced but is included in the values. The value of the production of this stock in 1915 was about $509,000.

The following table shows the quantity of the principal kinds of pine and spruce rough and planed lumber produced by the Swedish mills in the different Provinces in 1915, together with the totals for 1914.

PINE AND SPRUCE LUMBER PRODUCED BY SWEDISH SAWMILLS AND PLANING MILLS IN 1915.

Provinces.	Rough lumber (planks, battens, and boards).[a]	Planed lumber.	Total rough and planed lumber.	Split wood (mill ends).	Laths, molding stock, etc.	Box shooks.	Staves.[b]	Total rough and planed lumber, split wood, laths, etc.
	Mfeet.	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*
City of Stockholm	9,547	2,312	11,859	.....	127	305	114	12,405
Stockholm, rural districts	27,610	6,491	34,101	616	636	76	443	35,872
Upsala	64,623	6,123	70,746	3,627	677	1,443	821	77,314
Sodermanland	36,972	10,135	47,107	438	166	12,514	137	60,362
Ostergotland	57,812	16,133	73,945	229	726	764	463	76,127
Jonkoping	30,803	11,974	42,777	4	1,965	1,862	196	46,804
Kronoberg	39,569	8,146	47,715	.....	620	8,490	1,506	58,331
Kalmar	31,996	11,138	43,134	245	161	1,852	443	45,835
Gotland	240	598	838	.....	45	1	.....	884
Blekinge	5,594	3,718	9,312	.....	99	.....	142	9,553
Christianstad	7,757	22	7,779	195	556	36	2,509	11,075
Malmohus	1,424	2,117	3,541	.....	84	2,434	603	6,662
Holland	4,587	1,386	5,973	.....	84	892	649	7,598
Goteborg and Bohus	35,542	19,490	55,032	.....	339	88,829	127	144,327
Elfsborg	19,811	8,627	28,438	160	510	1,582	402	31,092
Skaraborg	21,253	3,973	25,226	137	106	1,482	25	26,976
Vermland	137,136	17,040	154,176	3,331	777	11,036	2,315	171,635
Orebro	63,401	6,044	69,445	801	1,108	3,283	478	75,115
Vestmanland	42,314	11,044	53,358	560	500	674	644	55,736
Kopparberg	132,743	44,068	176,811	1,925	2,043	16,208	6,028	203,015
Gevleborg	241,974	86,706	328,680	19,255	2,833	5,593	9,337	365,698
Vesternorrland	507,612	80,763	588,375	52,549	8,638	26,283	20,662	696,507
Jemtland	28,183	19,406	47,589	502	283	318	2,091	50,783
Vesterbotten	148,765	40,041	188,806	21,114	7,213	418	6,550	224,101
Norrbotten	178,416	4,506	182,922	18,773	6,759	848	6,038	215,340
Total, Sweden, 1915	1,875,684	422,001	2,297,685	124,461	37,055	187,223	62,723	2,709,147
Total, Sweden, 1914	1,713,191	529,279	2,242,470	135,408	34,202	125,633	73,442	2,611,155

[a] Not including rough lumber produced as raw material for planing mills.
[b] Including about 3,500,000 feet of species other than pine and spruce.

It is seen from the foregoing table that the most important sawmills are located in Norrland. The western coastal districts figure prominently in the manufacturing of box shooks and planed lumber, and these districts are also the center for important joinery factories.

The introduction of steam sawmills in Sweden revolutionized the sawmill industry. Formerly the mills were located at the waterfalls in the interior, which involved heavy cost for transportation of the lumber destined for export. When the mills were operated by steam power, the question of location was made independent of the presence of waterfalls, and nearly all the export mills, therefore, were located near the coast at the mouths of the floating rivers.

Floating is by far the cheapest way of transporting wood, and the export mills located at the shipping ports have a great advantage over the mills located in the interior which ship their lumber for export by rail.

In southern Sweden the mills are located along the railroad lines and are usually operated by peasants as a branch of their principal activity, agriculture. Many mills are also operated by lumbermen acquiring contracts for the logging of timberlands; their mills are usually of the portable type and are moved from year to year to different parts of the country where they may have taken over contracts for logging.

The defective floating facilities in southern Sweden have made it difficult to operate large sawmills. Many of the mills in southern Sweden are inefficiently operated; they pay slight attention to the saving of raw material and their equipment is often unsatisfactory, circular saws, defective edgers, etc., largely affecting their output. In northern Sweden the mills are of a larger capacity, well established, and supported by extensive timber holdings. Only a few mills of this type are found in southern Sweden, but some of these few are among the best-equipped mills in the country. In central Sweden there are several important sawmill districts, particularly around Lake Wenner.

The mills in Norrland, north of the Dal River, play a prominent part in the export lumber trade, as about 75 per cent of the total quantity of lumber for export is shipped through the Norrland ports.

The principal sawmill districts in Sweden are as follows: On the coast of Norrland—Haparanda, Lulea, Pitea, Skelleftea, Umea, Hernosand, Sundsvall, Hudiksvall, Soderhamn, and Gevle; south of Stockholm—Norrkoping; on the southwest coast, Goteborg; and on Lake Wenner, Karlstad. There are also important interior districts in southern and central Norrland and Dalecarlia shipping by rail.

OWNERSHIP OF MILLS.

During the last half century, the development in Sweden has been toward operating the mills by stock companies.

The latest statistics available, showing the ownership of the sawmills and planing mills, the number of mills, and the hands employed in 1915 and 1916, are as follows:

Classes of ownership.	1915		1916	
	Number of mills.	Number of hands.[a]	Number of mills.	Number of hands.[a]
Individuals	479	6,671	598	8,227
Companies	465	31,421	518	34,175
Institutions, etc	169	3,577	222	4,183
Economic associations	10	61	17	128
State	9	152	10	151
Total	1,132	41,882	1,365	46,864

[a] At the time the statistics were obtained.

The Government mills are small mills scattered in the different parts of the country; their importance is very limited and their production is not based on export. One of the mills cut only railroad ties for the State-owned railroads.

SAWMILL ORGANIZATION.

The larger mills in Sweden are engaged not only in cutting lumber, but also in manufacturing other wood products. It is generally considered that the sawmill industry alone is not profitable for a forest owner. The value of the raw material is high and the waste must be turned into profit; therefore, the sawmills and planing mills form only a part of a large combination of different industries, all using wood as

raw material for their products. It is evident that these conditions are of great importance, because if one branch fails to make a profit one year, the other branches may be of support in order to make a profit on the whole operation. Furthermore, improvements in the forest, mills, etc., can be accomplished more readily because their expense may be distributed among all the industries that obtain their raw material from the forests and mill waste.

During recent years, a consolidation of the different wood-using industries has been noticeable. Some mills may have insufficient supplies of raw materials while other mills may have large timber stands and limited manufacturing facilities. These two categories of industries frequently combine. The largest combination of this kind in Sweden was effected during the war and one company in northern Norrbotten was established by a consolidation of several mills. This company has a dominating position in this part of Sweden, producing annually 178, 000, 000 feet board measure of sawn lumber, 30,000 tons of mechanical pulp, 10,000 tons of soda pulp, and 30,000 tons of pig iron, besides large quantities of charcoal. This company also operates a number of agricultural properties and has more than a million acres of timber land.

Most of the larger sawmills are operated in connection with planing mills, box factories, and charcoal plants. Besides these, the mills usually have sulphite and sulphate mills and may even have paper mills. These mills are operated partly on the raw material obtained from sawmill waste and partly from pulp logs, which can not profitably be sawn into lumber.

Charcoal is used in smelting iron ore and many of the larger companies also operate iron and steel plants. The scarcity of many commodities during the war caused a further development of the wood by-products industry in Sweden, mainly utilizing waste from the pulp factories for manufacturing a number of chemicals. One of the remarkable developments during the war was the making of cattle feed from pulp by a special process; in many cases this pulp was mixed with flour for making bread. In this way the Swedish people not only derived great financial benefit from the forests but also managed to turn wood into food products in time of stress.

It was sometimes found during the war that the mills derived a greater financial return from sawmill waste than from the sale of sawn and planed lumber. To bear out this fact, a statement was given by a large mill in Norrland, producing about 40,000,000 feet board measure of lumber annually, from which it appeared that the mill's profit on the sale of sawmill waste in 1918 was about $235,000; in 1917, $98,000; in 1916, $83,000; and in 1915, $29,000.

It is evident that the smaller mills not able to utilize the waste in the same way as the large mills have difficulty in existing, particularly because they can not afford to pay as high prices for raw material as the larger mills because the larger mills can utilize practically the whole log.

The accompanying chart, showing administrative organization, gives an idea of the large proportions of some of the Swedish wood-using industries.

Not all the large sawmills maintain all the activities shown in the diagram, but there are mills in Sweden that actually operate on such a large scale. Formerly many sawmills in Norrland had often been oper-

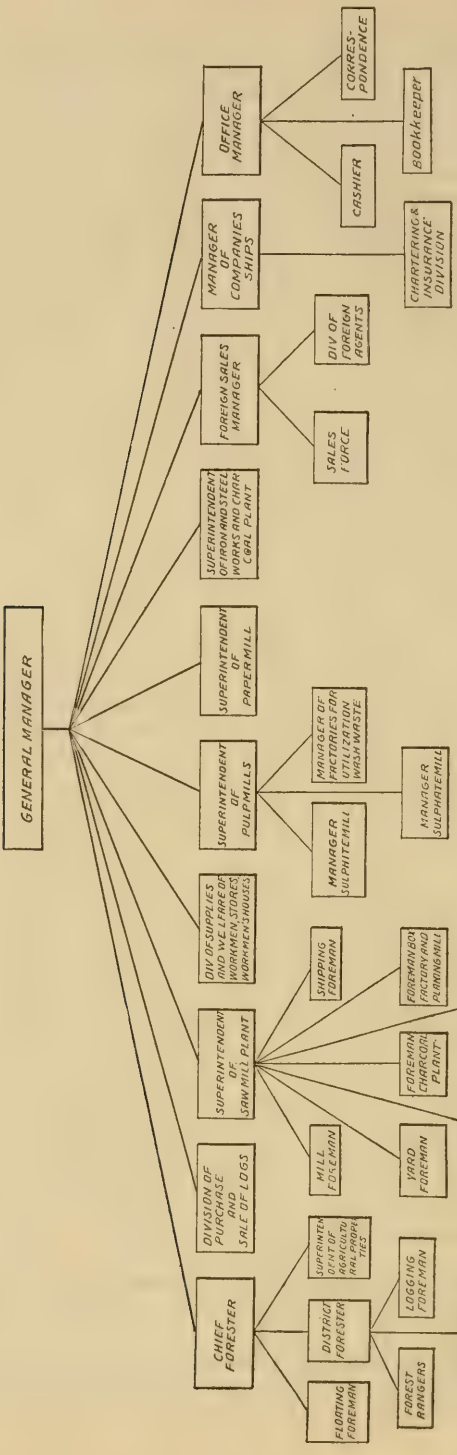


FIG. 40.—Plan of administrative organization of sawmill.

ated with insufficient capital. These mills were necessarily in the hands of the banks and were often forced to dispose of their forests in order to meet their obligations. Some mills were also, to some extent, dependent upon financial support from some of the largest foreign agents, but during the war the financial position of nearly all sawmills in Sweden was materially improved, and it is not supposed that any mills, at the present time, are dependent upon foreign financial support. The smaller sawmills, on the other hand, are to a great extent, dependent upon advances made by domestic export agents.

There are very few mills in foreign ownership at the present time; the sawmill industry in Sweden must be considered to be almost exclusively Swedish-owned.

The export mills in Sweden specialize in cutting stock for export, and do not generally handle any domestic orders. The domestic demands are supplied by smaller mills and the specifications are entirely different from the dimensions shipped for export, so that the mills can not cater profitably to both markets.

EXPORT MILLS.

The average standard export mill in Sweden may have an annual capacity of 15,000,000 to 18,000,000 feet board measure. The Swedish export mills are of somewhat smaller average capacity than the mills in Finland but considerably larger than the Norwegian mills. The reason for these conditions is that the Swedish mills are more dependent than the mills in Finland upon the log supply required from other sources than their own forests and also on account of the fact that the Swedish pulp industry is very considerable and takes a large quantity of logs that in other countries would be used by the sawmills.

The largest Swedish mill has a capacity of approximately 85,000,000 to 90,000,000 feet board measure per year and is equipped with about 30 gang saws. These gang saws are of old construction; the number of modern gangs necessary to turn out the quantities mentioned will be about 16. This mill employs about 1,000 hands and is located near Gevle, in southern Norrland. There are several mills in Sweden of an annual capacity of 40,000,000 to 60,000,000 feet, but it is now commonly believed that it is not economical to operate such large mills, because it is difficult to regulate the production in dull times. It is considered preferable to operate several smaller mills, as any one of these mills may be conveniently shut down without interfering with the operation of the other mills.

The most suitable size of sawmill in Sweden may cut approximately 15,000,000 to 16,000,000 feet board measure per year, having an equipment of 6 modern gang saws and running one shift. In the future it is believed that no mill of any larger capacity than 20,000,000 to 30,000,000 feet board measure will be constructed.

Only the sawmills in southern and central Norrland are connected with box factories and planing mills because the wood in the northernmost sections of Norrland is not exceptionally well suited for planing purposes and the marketing conditions are not so favorable in that part of the country. During the war the box-shook industry boomed and many new factories sprang up, supplying box material for the warring nations.

The complete layout of a modern mill, yards, docks, etc., is shown in figures 58, 59, and 60.

Nowadays the making of plans for sawmills is left to engineering firms that make a specialty of this work, while formerly the sawmills were constructed in the less efficient way by contractors who did not always have the necessary knowledge of all the phases of the lumber industry.

COST OF CONSTRUCTION.

The cost of construction of a sawmill plant based on an annual production of 15,000,000 to 16,000,000 feet board measure (working one shift 57 hours per week) was as follows in 1918:

Power plant fully equipped (engine, 500 horsepower)	$40,000
Mill and machinery (6 gang saws, 3 edgers, 2 resaws, and necessary small machines, such as trimmers, lath machinery, belts, transmission, including mill construction)	94,000
Log pond	13,000
Yard, equipped with rail system, cranes for piling, docks, trimming sheds, etc.	80,000
Workmen's houses, office buildings, etc	94,000
Electric-light plant	13,000
Roads, draining, etc	11,000
Various expenditures	16,000
Total	361,000

The total cost of the plant per 1,000 feet board measure capacity was thus about $22.90, or $60,300 per gang saw in 1918. The total cost of this plant in 1914 would have been $11.50 per 1,000 feet capacity, or $30,820 per gang saw.

CREW.

The crew of a sawmill with an annual capacity of about 16,000,000 feet board measure per year would be about as follows:

Pond (6 men): 1 log scaler, 1 assistant log scaler, 2 boom men, 2 men on bull chain.

Mill (62 men): 1 superintendent, 6 head sawyers, 6 assistant head sawyers, 3 edgermen, 3 assistant edgermen, 3 trimmers, 3 assistant trimmers, 2 sawyers of staves, 2 assistant sawyers of staves, 2 trimmers of staves, 2 loaders of staves, 1 sawyer of other small dimensions, 1 assistant sawyer of other small dimensions, 1 trimmer of slabs, 3 loaders of small dimensions, 3 boys handling refuse, 2 graders, 2 assistant graders, 1 oiler, 1 fireman, 1 engineer, 1 assistant engineer, 1 filer, 1 assistant filer, 1 clean-up man, 3 common laborers, 1 blacksmith, 1 assistant blacksmith, 1 carpenter, 2 watchmen, 1 tallyman.

Yard (22 men): 1 superintendent, 1 assistant superintendent, 18 pilers, 1 engineer (locomotive), 1 switchman.

Dock (4 trimming sheds, 43 men): 4 boys removing refuse, 5 men trimming and loading split wood, 4 boys branding lumber, 1 old man or 2 boys for piling staves (who may also be used when loading staves), 5 men cleaning up in yard, and common laborers pumping barges, etc., 8 men loading lumber or conveyors in yard, 2 assistant foremen, 4 graders, 4 trimmers, 4 men in barges.

Thus the total would be 133 employees, not including 4 men who operate log elevators during the winter.

MILLS FOR CUTTING TIES.

Some mills are especially constructed for cutting ties. Most of the ties exported from Sweden are for use in the mines in the United Kingdom. The mills are equipped with circular saws and are similar

FIG. 41.—SORTING BASIN FOR LOGS.

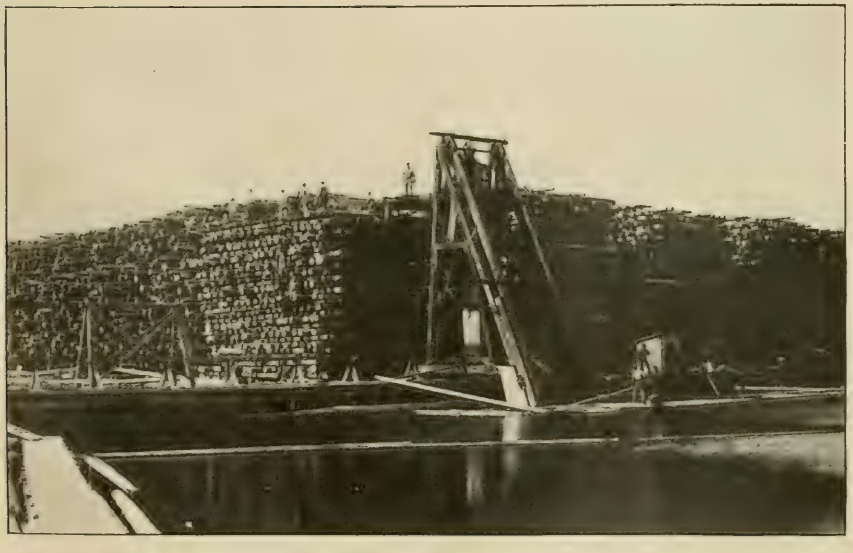


FIG. 42.—PILING LOGS ON LAND.

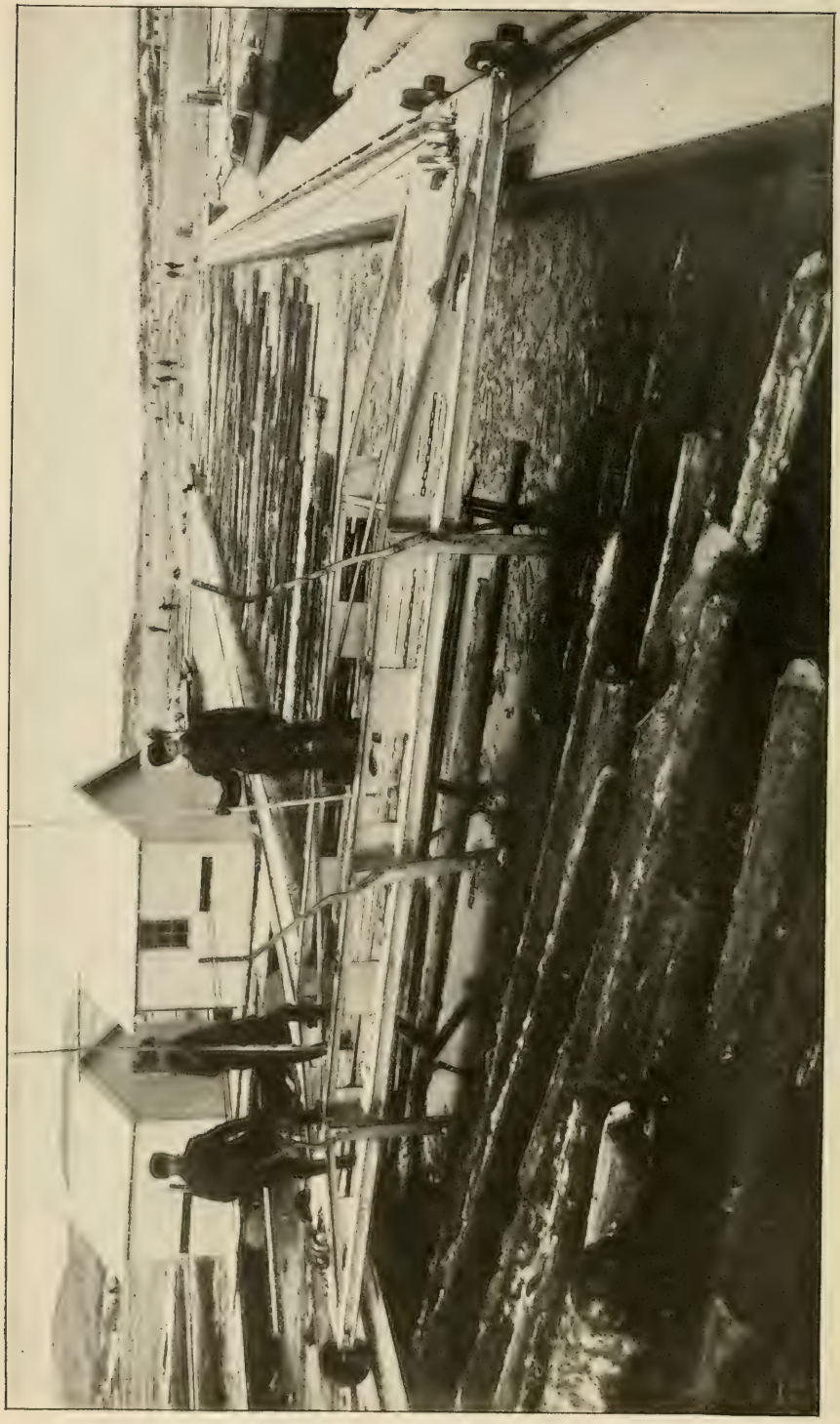


FIG. 43.—APPARATUS FOR BUNCHING LOGS IN SORTING BASIN, ANGERMANN RIVER.

in construction to the edgers. In 10 hours about 1,200 to 1,600 six-foot ties may be produced by two men.

The usual dimensions of ties cut in Sweden are as follows: 3 by 6 inches; $2\frac{7}{8}$ by $5\frac{3}{4}$ inches; $2\frac{1}{2}$ by 5 inches; $2\frac{3}{8}$ by $4\frac{3}{4}$ inches. The lengths are 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$, 5, $5\frac{1}{2}$, and 6 feet.

The saw must touch all four sides. It is required, however, that the ties must have at least $1\frac{1}{2}$ to 2 inches of sawn surface on the widest sides of the piece.

The following table shows the number and dimensions of ties that are usually cut from logs of different top diameters:

Top diameters.	Number of ties.	Dimensions.	Top diameters.	Number of ties.	Dimensions.
		Inches.			*Inches.*
5–5½ inches	2	2⅜ by 4¾.	6½–7 inches	2	3 by 6.
5½–5¾ inches	2	2½ by 5.	7½–7¾ inches	3	2⅞ by 4¾.
6–6¼ inches	2	2⅞ by 5¾.	8–8¼ inches	3	2½ by 5.

The refuse from the tie mills is cut into staves, box shooks, etc.

According to Forester M. Nordquist, the cost of sawing ties of different sizes in 1916 was as follows in cents per 100 ties. These charges do not include trimming.

Lengths in feet.	3 by 6 inches.	2⅞ by 5¾ inches.	2½ by 5 inches.	2⅜ by 4¾ inches.
	Cents.	*Cents.*	*Cents.*	*Cents.*
6	26.8	24.1	21.4	18.8
5½	26.8	24.1	21.4	18.8
5	24.1	21.4	18.8	16.1
4½	21.4	18.8	16.1	16.1
4	21.4	18.8	16.1	13.4
3½	18.8	16.1	13.4	13.4
3	18.8	16.1	13.4	13.4

GOVERNMENT-OPERATED MILLS.

In the State forests, the Government operates 17 small mills. In 1915, 227,233 logs, or 1,232,585 cubic feet, were sawn and the total production amounted to 40,493 cubic feet of railroad ties, 796,746 cubic feet of lumber of different kinds, and 7,827 cubic feet of construction timber. The cost of production (sawmilling and yarding) was given at 3.9 cents per cubic foot.

Of the total quantities of lumber produced at these mills, including old stock, the following quantities were sold:

702,890 cubic feet of lumber	$162,781
41,211 cubic feet of railroad ties	6,184
284,903 cubic feet of wood for various purposes	10,060
70,787 cubic feet of lumber for various purposes	13,346
Total	192,371

It is claimed that the Government has been able to make better profits by manufacturing its timber into lumber instead of selling the timber standing or cut into saw logs, and the question is now under consideration whether the Swedish Government should follow the example of the Finnish Government by engaging in the sawmill and

pulp industry on a large scale in order to increase the profits derived from the operation of the State forests.

POWER.

Most of the mills in Sweden are operated by steam power generated by sawmill waste. Modern steam engines operating with superheated steam reduce the consumption of fuel 30 to 50 per cent from that of the older steam engines. In some districts the waste is too valuable to be used for fuel and the sawmills may burn coal and turn the waste into pulp or sawdust briquet, the latter being used for smelting ore. The most modern plants are operated by electricity, every machine in the mill having an individual motor. The electric power is generated either from waterfalls or by burning sawmill waste. It is the hope of the Swedish lumbermen in Norrland, in the future, to operate the sawmills by electricity. It is estimated that 50,000 horsepower will be necessary for this purpose, and this could easily be obtained by utilizing the water power in the rivers of Norrland.

Recently a few modern plants have installed plants generating gas (mono gas) from the sawmill refuse. It is claimed that about 50 per cent of the consumption of sawmill waste for fuel can be saved by this process, and in addition, valuable by-products are obtained, such as wood tar. The advantage of the "mono-gas system" is that dry and green wood are equally good as fuel.

It is generally calculated that a steam engine of about 500 horsepower would require 1,700 to 1,800 cubic feet of sawdust and other refuse per shift of 10 hours. Most of the mills also operate electric-light plants.

LOG PONDS.

When the logs are towed from the log-sorting basin in the rivers to the mill, provisions are made for storing logs either in log ponds or on land. During the winter the water freezes and extraordinary measures must be taken to store the lumber in such a way that it will be easily accessible. This may be done by piling the logs on land in huge piles, each containing one dimension, based on the top diameter, which work is done by log elevators having a capacity of 150 to 200 logs per hour; or the logs may be piled crosswise in 13 to 15 tiers and stored under the ice.

One system consists of drawing one tier of logs partly upon land, and then drawing the other tiers close onto the first tier so that about one-fourth of the log lengths protrude out of the water.

The log ponds are divided into several pockets to separate pine logs from spruce logs and also to sort these logs according to top diameters and grades. Some mills sort the top-diameter dimensions on the half-inch, while closer utilization of the logs calls for sorting on the quarter inch. Short log lengths are sometimes separated in the ponds from standard log lengths and in the most efficiently operated mills the logs are also separated according to quality.

It is very important to effect this sorting carefully, as there is a different sawing schedule for each of the categories named.

During the winter when the water freezes, either the logs must be hauled from the piles on land or an open canal may be made in the pond by exhaust water from the boiler. This system has the disadvantage that the facilities for sorting the logs before they are taken to the mills are at times unsatisfactory. In order to improve these conditions several mills in northern Sweden have hot ponds. These ponds are usually 110 to 134 feet wide and 175 to 350 feet long. The walls are constructed of 4-inch planks and during the summer the wall facing the mill is removed. It is estimated that by using this system of log ponds, the sawing capacity of the mills, during the wintertime, is increased about 10 per cent and the logs may be sorted efficiently. In the ponds there are usually installed cross-cutting saws to buck the logs into suitable lengths, as some mills are taking logs in entire tree lengths from the forests. Logs defectively crosscut in the woods are also crosscut in the ponds before they are taken to the mill.

Before the logs are pulled up the gangway to the mill they are carefully inspected by the scaler, who directs the logs to the proper gangsaw set for the cutting of each dimension and grade.

During late years a very practical apparatus for transporting logs from ponds to mill has been inaugurated. Formerly several logs were bunched and hauled up the gangway on chains, but this system required a great deal of power. A new system has a gangway for each gang saw and the bull chain is provided with steel carriers having an edge like a saw, whereby the logs are held firmly in place. The distance between these metal carriers varies from 5 to 5¾ feet. The logs are merely pushed onto the chains in the ponds and carried up the gangway to the mill. When the logs are placed in front of the saw carriage, the top end touches a lever connected with the belt, which is shifted to the loose pulley, and the operation is thereby interrupted. As soon as the log is removed from the chain, the belt is transferred by a weight to the fixed pulley and the next log is hauled up. By means of the new system, the services of several men in the pond and on the log deck can be dispensed with.

MILL CONSTRUCTION AND MACHINERY.

The sawmills are built of wood; no steel mills are found in Sweden. Usually the sawing of lumber and the utilization of waste products are combined in one mill, but in some cases a special annex is constructed, adjacent to the sawmill, for sawing slabs, edgings, etc., into laths, broom handles, box shooks, and similar stock. This latter system has many advantages, especially in the case of large operations. Some of the larger sawmill companies operate two plants, one for pine and the other for spruce.

The mills are usually constructed in two stories. In the basement, the foundation of the gang saws, conveyors for sawdust, and machines for cutting refuse into chips for pulp mills (hogs) are located. On the upper floor the sawmill machinery is installed. Most of the mills are built to cut logs up to 35 to 40 feet in length, but such log lengths are seldom sawed, the maximum being 27 to 30 feet.

The Swedish sawmill machinery is believed to be superior to other types in accuracy of sawing and saving of material. Several large factories in Sweden turn out sawmill and planing-mill machinery

for both domestic and foreign markets. The principal feature about the Swedish machines is the excellent steel used in their manufacture, which enables the machines to turn out carefully manufactured stock.

Gangsaws are used by the Swedish standard mills, while circular saws are commonly found in the mills operated on a small scale.

An American band saw was installed in one of the larger mills in Sweden a few years before the war, but this type was found impracticable for Swedish conditions on account of the waste and the large percentage of miscuts. The Swedish logs are of too small dimensions to make the use of American band saws possible and the percentage of clears is insignificant, so that the band head saw is not suitable for this material.

Many of the larger Swedish export mills are equipped with machinery of the Bolinders type, and a short description of these machines is given below because they are generally considered as standard in northern Europe. The principal features of these machines have been patented by the manufacturer.

Part of the following information has been supplied by the manufacturers, J. & C. G. Bolinders, Mekaniska Verkstads A/B., Stockholm, concerning the machines that they turn out:

GANG SAWS.

The gang saws used in Sweden are constructed 20, 24, 30, and 33 inches in sash width. The bedplate is of heavy design and is constructed so as to absorb vibration, insuring smooth running. The crank shaft is of the so-called "machined" type and the two webs of the crank are fitted with counterweights for balancing the momentum of the saw-blade frame and connection rod, whereby shocks at either end of the stroke are avoided.

The bearings are of the self-acting ring oiler type, lined with white metal. They are furnished with felt packing at each end to prevent the entrance of dust and dirt. The bearings are brought as close to the crank as possible, which makes the machine reliable in operation. The flywheels are located one at each end of the shaft outside the bearings. The connecting rod is of strong construction, and the heads are so designed that the necessary adjustments may be made easily. The solid construction of the sash is one of the most important details of the gang saw. The capacity of the machine is dependent upon the feed mechanism. The 20 and 24 inch gangs are provided with continuous feed mechanism, which can be regulated while the machine is working. By a simple movement the operation can be instantly stopped or reversed, if necessary. The 30 and 33 inch gangs, as a rule, are, fitted with an intermittent feed mechanism.

The upper feed rollers, which are power driven, are self-setting without any assistance from the operator. This is due to the fact that the lowest position of the upper rollers is changeable and under the control of springs in a vertical direction. This position can be adjusted to the size of the log that is being sawn. For example, in the case of sawing a log 9 inches in top diameter, the lowest position of the upper feed roller is adjusted, so that the opening between the upper and lower feed rollers is 8½ inches. As the log passes through the sash the top roller raises itself. When the log has passed through the sash, the upper roller falls back without shock to its original posi-

tion 8½ inches above the lower roller, ready to receive another 9-inch log. The upper roller works in a frame, which is pivoted to one side of the machine and can be swung clear readily, so that the sash becomes easily accessible, which is an advantage when inserting or changing blades.

The crank pin is continuously lubricated through the crank shaft from the lubricator, and the guides from oil pumps are all mechanically driven. The loose pulley runs in ball bearings.

The following table shows the specifications for the principal standard sizes of gang saws in Sweden:

Width of saw sash.	Length of stroke.	Revolutions per minute.	Necessary brake horsepower.	Driving pulleys.		Bedplate.	
				Diameter.	Face.	Length.	Width.
Inches.	*Inches.*			*Inches.*	*Inches.*	*Inches.*	*Inches.*
20	20	350	30	39	8½	71	57
24	20	325	30	39	8½	71	57
30	20	290	30	39	8½	71	57
33	20	275	30	39	8½	71	57

Larger types of gang saws, having sashes 36 and 42 inches wide, are also made in Sweden, but these gang saws are manufactured mainly for export, particularly to the Russian market.

For each saw there are two pairs of log carriages, one pair in front of the saw and the other behind. While formerly the sawyer had to place the log in position on the carriage by lifting or rolling, this work is now handled by a foot lever (similar to "steam niggers" in American mills). The one front carriage is constructed so that the logs may easily be turned and placed into position on the carriage by a pair of claws operated by a handle. After the log has passed through the gang, the carriage is moved automatically back into position for the next log. Instead of using similar log carriages at the rear end of the saw, sometimes two steel arms running on rails under the roof are employed.

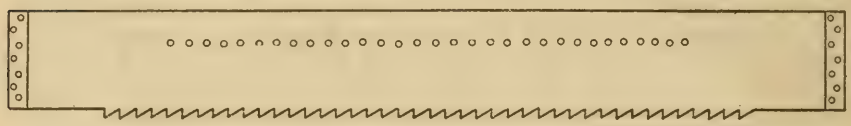
The lumber is transferred over to the conveyors by a pair of steel arms operated by foot levers. By these improvements the heavy work in the sawmills is materially decreased, as the sawyers, practically speaking, do not touch the logs or the lumber.

The use of special gangs for sawing crooked logs is an example of Swedish thoroughness in effecting the largest possible saving in raw material. Instead of being crosscut into smaller log lengths, these logs can be sawed on the special gangs. The rail on which the carriage runs can be moved to either side of the gang, whereby crooked logs can be turned so that the saws cut parallel with the grain. Another system has a number of rollers, which can be turned at an angle to permit sawing to follow the bend of the log when passing through the gang.

Some of the gang saws have been constructed for cutting two logs at a time; but this system has now been abandoned because the modern single gang saw is as effective as the double gang saw of the old type, and this double gang saw required three operators, while the modern type requires only two. Furthermore, trouble is often experienced in sawing different log lengths at one time, and the

double gang saw also has a tendency to cut with less accuracy than the single gang saw.

The present types of gang saws represent an important improvement over gangs used 5 or 10 years ago. The speed of the new types has been increased about 77 per cent above the speed of former types. The present standard gangs turn out per hour on an average 48 logs less than 10 inches in top diameter, and of an average length of 18 feet, while formerly only 27 logs per hour were sawn. This estimate includes the time necessary for breakdowns, clearing and placing logs in position on the log carriages, etc. This increased capacity of the gang saws, therefore, will partly offset the heavy increase in wages paid to sawmill laborers at the present time.



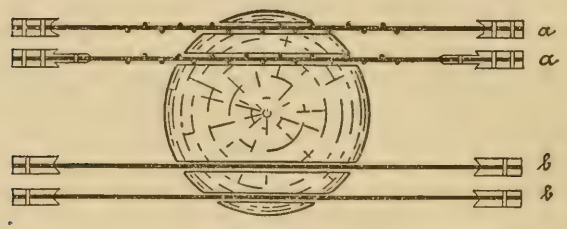


FIG. 44.—Standahl's saw blades (*a*) and ordinary saw blades (*b*).

SAW BLADES.

The saw blades used in the gang saws are made of the best Swedish steel. The thickness of the blades has constantly been reduced during the last few years, and the common type now used in the mills is 17, 18, and 19, Birmingham wire gauge. To change from 14 to 17 B. W. G. means a saving in raw material of about 3 per cent. The filing is always done by special machinery. Lately an improved system of swaging has been instituted whereby the teeth are bent only at the point and slightly turned at the same time and not, as formerly, swaged from the base. By this procedure the kerf has been made considerably smaller. There are special machines for swaging the teeth in this way. Some mills use very thin saw blades, 20 and 21 B. W. G. These blades have one row of bumps on each side of the blade close to the back of the blade, whereby the saw blade is given a conical shape, enabling the mills to use a smaller swaging and consequently entailing less waste. It is claimed, however, that the speed of sawing is somewhat decreased and the use of these blades

is dependent upon whether the value of the saving in raw material and in waste will offset the increased cost of labor. (See fig. 48.)

The following table shows the allowance for swaging and kerf for saw blades of various thicknesses, according to the Birmingham wire gauge:

No.	Thickness of blade.	Swaging.	Kerf.	No.	Thickness of blade.	Swaging.	Kerf.
	Inch.	*Inch.*	*Inch.*		*Inch.*	*Inch.*	*Inch.*
6	0.203		0.262	17	0.058		0.097
7	.180		.239	18	.049	0.039	.088
8	.165		.224	19	.042		.081
9	.148		.207	20	.035		.074
10	.134		.193	21	.032	.030	.062
11	.120	0.059	.179	22	.028		.058
12	.109		.168				
13	.095		.154				
14	.083		.142				
15	.072		.131				
16	.065		.124				

Circular saws are never used for cutting ordinary logs in standard Swedish mills, because they do not turn out lumber sufficiently accurate in manufacture to meet the requirements of foreign customers. The standard mills use circular saws only for cutting small timber.

EDGERS.

It is generally figured that one edger is sufficient to take care of the output of two gang saws when a rational system of sawing is applied (passing through the gang saw twice logs 7 inches and more in top diameter).

Three principal types of edgers are used in the Swedish mills. The largest size is used especially for edging small timbers and heavy construction materials. This type will edge lumber 2 to 20½ inches in width and up to 8 inches in thickness. The medium-sized edger is the standard type in all larger mills. It will size lumber 2 to 14 inches in width and up to 6 inches in thickness. A smaller type is used in the smaller mills and will edge lumber 2 to 12 inches in width and up to 4 inches in thickness. There are also various types for edging staves and other small-dimension lumber, which are constructed along the lines of the edgers described.

The following table shows various items connected with the operation of the large, medium-sized, and small edgers:

Items.	Large.	Medium-sized.	Small.
Distance between centers of feed rollers.....inches..	49½	47¼	40½
Rate of feed.....linear feet per minute..	200-230	200-230	165-200
Speed of arbor.....revolutions per minute..	1,800	1,800	1,800
Pulley:			
Diameter.....inches..	14½	14½	12½
Face.....do....	9½	9½	7½
Saw:			
Diameter.....do....	37⅝	25$\frac{19}{32}$	21$\frac{11}{32}$
Center hole.....do....	3⅜	3⅜	3
Pin hole.....do....	½	½	¾
Pin hole distance from center.....do....	2$\frac{3}{16}$	2$\frac{3}{16}$	2
Approximate power required.....brake horsepower..	25	20	15

A special feature with the more recent types of Swedish edgers is that the feed rollers are raised automatically at the moment they are brought in contact with the inserted lumber without the intervention of the operator. The lumber is driven toward the machine by a special feed mechanism. The edger is also provided with a reversing mechanism and the saw arbor runs in a double row of ball bearings. The adjustable saws are moved by a lever and the edgers are set with a simple device in order to give the lumber the required increase of width to provide for the shrinkage during the process of drying.

RIP SAW FOR SMALL-DIMENSION LUMBER.

The rip saw is fed by means of a small toothed wheel under the table, with its teeth projecting above the surface of the table. Owing to the construction of this feed wheel, the edging is pressed against the guide plate at the same time that it is moved forward. Above the table there is an upper feed wheel pivoted to a support and capable of raising or lowering itself to accommodate the lumber. The following are the specifications for this rip saw:

Feed, 230 lineal feet per minute.
Revolutions of spindle, 1,800 per minute.
Dimensions of spindle pulley, 8 by 5¼ inches.
Diameter of saw blade, 15¾ inches.
Diameter of center hole in saw blade, 2⅜ inches.
Power required, 7 to 8 horsepower.

HORIZONTAL BALANCED CROSSCUT SAWS.

The horizontal balanced crosscut saw is intended for crosscutting timber, lumber, and sawmill waste, and is made in three sizes. The saw spindle is journaled in a strong frame, which is balanced by means of a weight and which can be raised or lowered by either a hand or a foot lever. The driving belt of the saw spindle is tightened by a very simple arrangement, for which reason a belt woven in one piece can be used.

The following table shows the specifications for crosscut saws of the three sizes:

Items.	Large.	Medium-sized.	Small.
Diameter of saw.....inches..	39	28	20
Bedplate length and width.....do....	54½ by 22	48½ by 22	42½ by 17
Electric motor power.....horsepower..	7½	6½	4
Speed.....revolutions per minute..	1,000	1,375	1,800

TRIMMER FOR BOX SHOOKS, STAVES, ETC.

The trimmer for box shooks, staves, etc., is generally provided with two or three circular saws. The two outer saw blades can easily be set to cut for various lengths.

The specifications are as follows:

Items.	No. 1.	No. 2.
Number of saw blades	3	2
Cutting capacity ..... inches..	1 by 12–4½ by 4½	1 by 12–4½ by 4½
Maximum diameter of saws ..... do....	18	18
Diameter of center hole of saw ..... do....	2 3/8	2 3/8
Diameter of pin hole of saws ..... do....	1 3/8	1 3/8
Distance of pin hole from center ..... do....	55	48
Maximum distance between outer saws ..... do....	19½	9¾
Minimum distance between outer blades ..... do....	1,800	1,800
Revolutions of saw spindle per minute		
Driving pulley:		
Diameter ..... inches..	6 7/8	6 7/8
Face ..... do....	3½	3½
Revolutions per minute	1,800	1,800

MECHANICAL DEVICES FOR HANDLING LUMBER IN MILLS.

Formerly, when labor was comparatively cheap, not much attention was given to saving labor in the mills. During the last 10 years, however, the labor problem has steadily grown and at present the

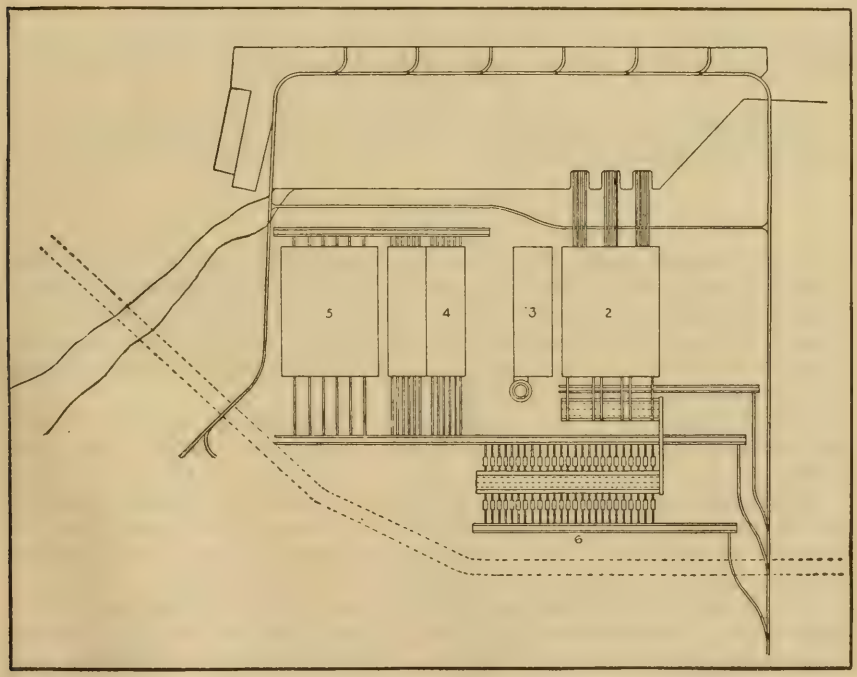


FIG. 45.—Plan of Swedish sawmill, box factory, and dry kiln. 1, log pond; 2, sawmill; 3, power plant; 4, dry kiln; 5, box factory; 6, sorting table.

prices paid for labor in the Swedish mills are very high. Lately, therefore, the mills have endeavored to decrease the expense of handling lumber by installing various labor-saving devices. Among these the automatic conveyors are of main importance.

The lumber is transported from one machine to another on live rollers, and slabs and edgings are transported in a similar way on

belts. In order to prevent accumulation of sawmill waste in the mill the belts for carrying refuse are generally installed on the lower floor of the mill and the refuse is dumped on these belts through openings in the upper floor. In some mills refuse is also transported on carriages running on a rail suspended from the roof.

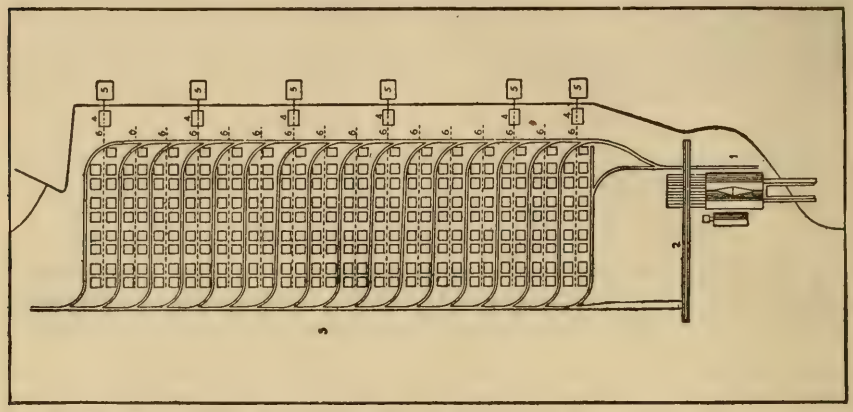


FIG. 46.—Plan of Swedish sawmill, yard, and docks. 1, sawmill; 2, car transfer; 3, yard; 4, trimming sheds; 5, barges; 6, conveyors.

The Swedish mills endeavor to have the lumber pass one way and to avoid transportation sidewise as much as possible.

SAWING.

As an average result of the sawing of standard logs in Sweden, the following example is given, the percentages being expressed in relation to the cubical contents of the logs based on top measurements: Planks, battens, and boards (trimmed stock), 70 per cent; sawdust, 8 per cent; shrinkage during drying, 4 to 5 per cent; slabs, edgings, etc., 12 per cent; mill ends, 6 per cent.

It is evident that the sawing results depend to a great extent on whether the mills pass the logs once or twice through the gang saws.

Practically the only part of the log that may be termed waste is the shrinkage. The Swedish sawmill industry, therefore, may be compared favorably with the packing industry in the United States, in which the only thing wasted is the squeal of the pig.

The quality of the Swedish lumber may not be so high as that of some of the softwoods of the United States, but the Swedish lumbermen endeavor to make their profits on the utilization of the logs and do not sacrifice quantity in order to produce quality. For Swedish conditions, this is the only sensible method of operation, and only by adhering to this policy can the Swedish lumbermen expect to hold the present firm position in the world markets.

The smaller mills of the portable type do not offer anything of interest, because the logs are sawn in a haphazard way and the waste is often as large as 20 to 25 per cent. These operations, therefore, will not be considered in this report.

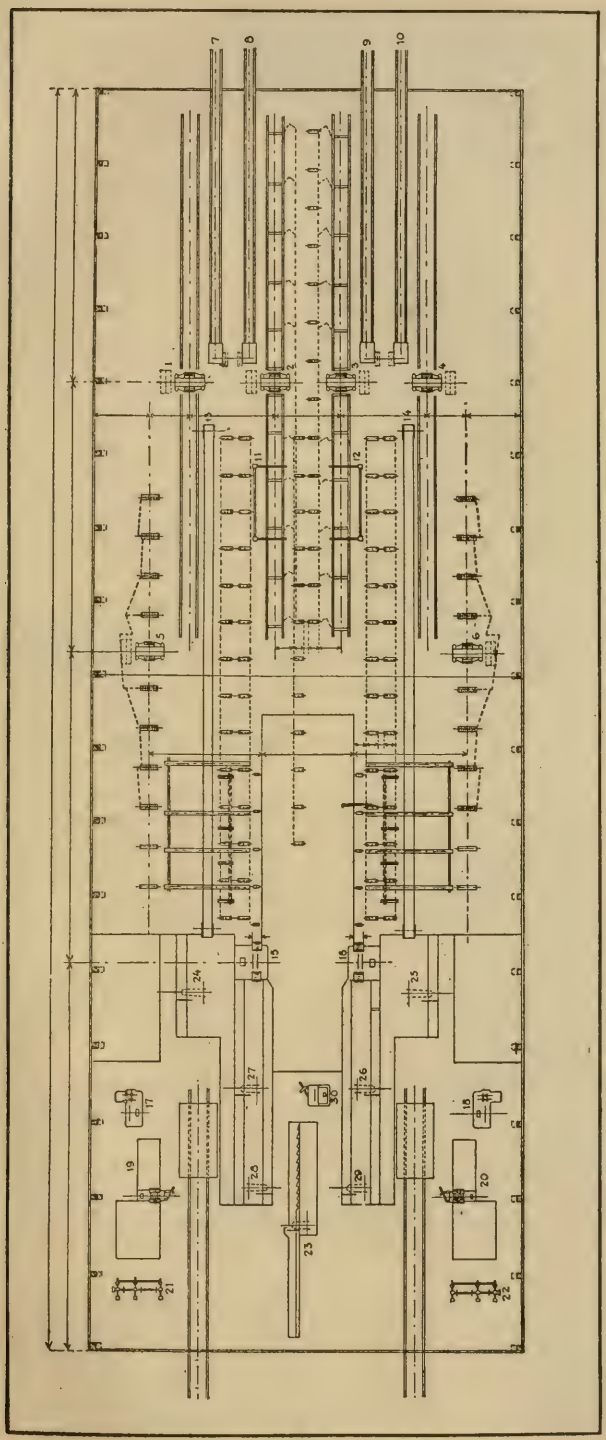


FIG. 47.—Plan of interior of Swedish sawmill. 1, 2, 3, 4, gang saws; 5, 6, gang saws for crooked logs; 7, 8, 9, 10, automatic conveyors; 11, 12, automatic transfer of lumber; 13, 14, conveyors for lumber; 15, 16, edgers; 17, 18, resaws for small-dimension stock; 19, 20, edgers for small-dimension stock; 21, 22, trimmers for small-dimenions stock; 23, 24, 25, 26, 27, 28, 29, trimmers; 30, edgers.

Spruce logs are sawn the year round, but pine logs are not sawn during the summer months, because pine is more liable to discolor during the summer. The sawing is effected according to special schedules, and each gang saw is adjusted to cut only one log dimension at a time. For instance, one gang may cut 6-inch logs for one week and 6½-inch logs the following week.

Before the sawing season starts the mills generally run three or four weeks on trial. During this period the contents of each log sawn is carefully estimated and also the quantity of lumber and waste produced from each log. A record is kept of each log and the sawing schedules used in each case in order to ascertain which schedules would give the best results, both in the output of lumber and in the manufacture of the sizes for which the best prices are obtained. Several mills in the same district sometimes cooperate in these trials, thereby reducing the cost of this operation and arriving at better conclusions than if each mill had operated independently.

The principle of rational sawing is to have as much lumber produced in the gang saws as possible, so that only a small percentage of the log has to be sawn on the smaller machines into laths, broom handles, staves, etc., because the sawing of this stock entails a cost 250 to 300 per cent higher than the gang sawing of lumber. The waste also is disproportionately large.

The number of logs required to cut 1,000 feet board measure of lumber varies a great deal. In special cases only 7 logs may be required, and in other extreme cases 30 to 35 logs. The usual number is 20 to 22 logs. On an average, standard mills require 118 to 120 cubic feet of raw material, based on top measurement of the logs, to produce 1,000 feet board measure of lumber (planks, battens, and boards).

There are people in Sweden who have devoted years to the study of sawing schedules, and many valuable tables are published that are of material assistance to the Swedish sawmill operators in selecting the most suitable sawing schedule for their logs. Not all the mills are equally careful in the utilization of the raw material. The most efficiently operated mills based their sawing schedules on the following factors:

(1) *Top diameter of logs and shape of logs.*—The logs are separated into different categories, based on each half inch or quarter inch of top diameter. This is for the purpose of obtaining the widest possible stock of each log with the least possible waste.

Furthermore, differentiation is often made in the sawing schedules between round and oval logs. (It is estimated that at least 80 to 85 per cent of all logs are oval.) For instance, to cut 3 by 9 inches, which is one of the principal stock dimensions, the log must be at least 9¾ inches in top diameter if round and 10 inches if oval. By sorting the logs on the one-fourth-inch top diameter, it is possible to obtain a larger quantity of lumber than by sorting on the one-half inch.

In the case of oval logs two different schedules are applied. If the logs are free from shakes, the schedule is based on sawing the logs in such a way that the largest top diameter of the logs is sawed parallel with the saw blade; in this way the widest stock is obtained. On the other hand, if the log has shakes or splits radiating from the center of the logs in the direction of the smallest diameter, the logs

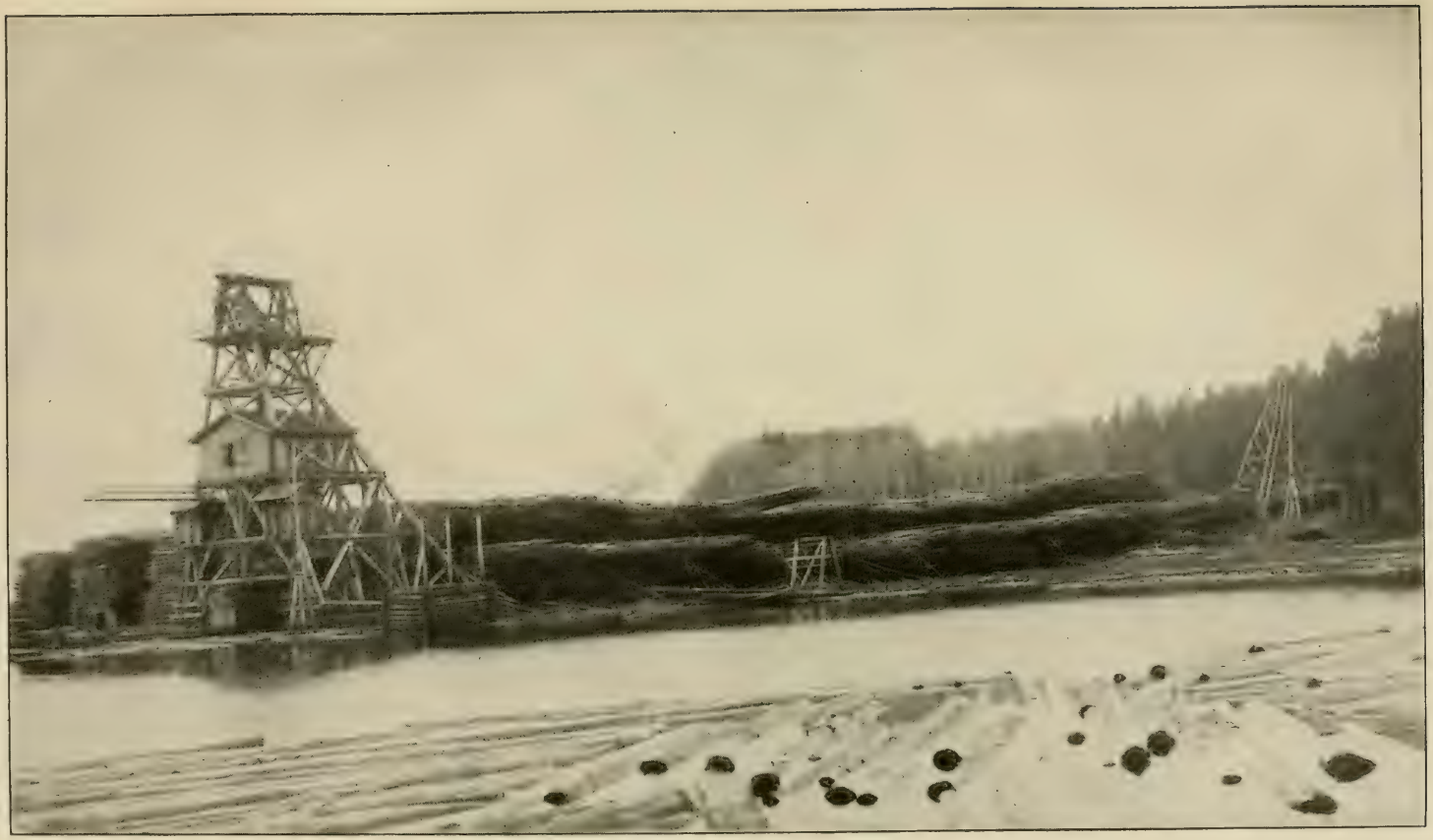


FIG. 48.—ERICSON SYSTEM OF PILING LOGS ON LAND.

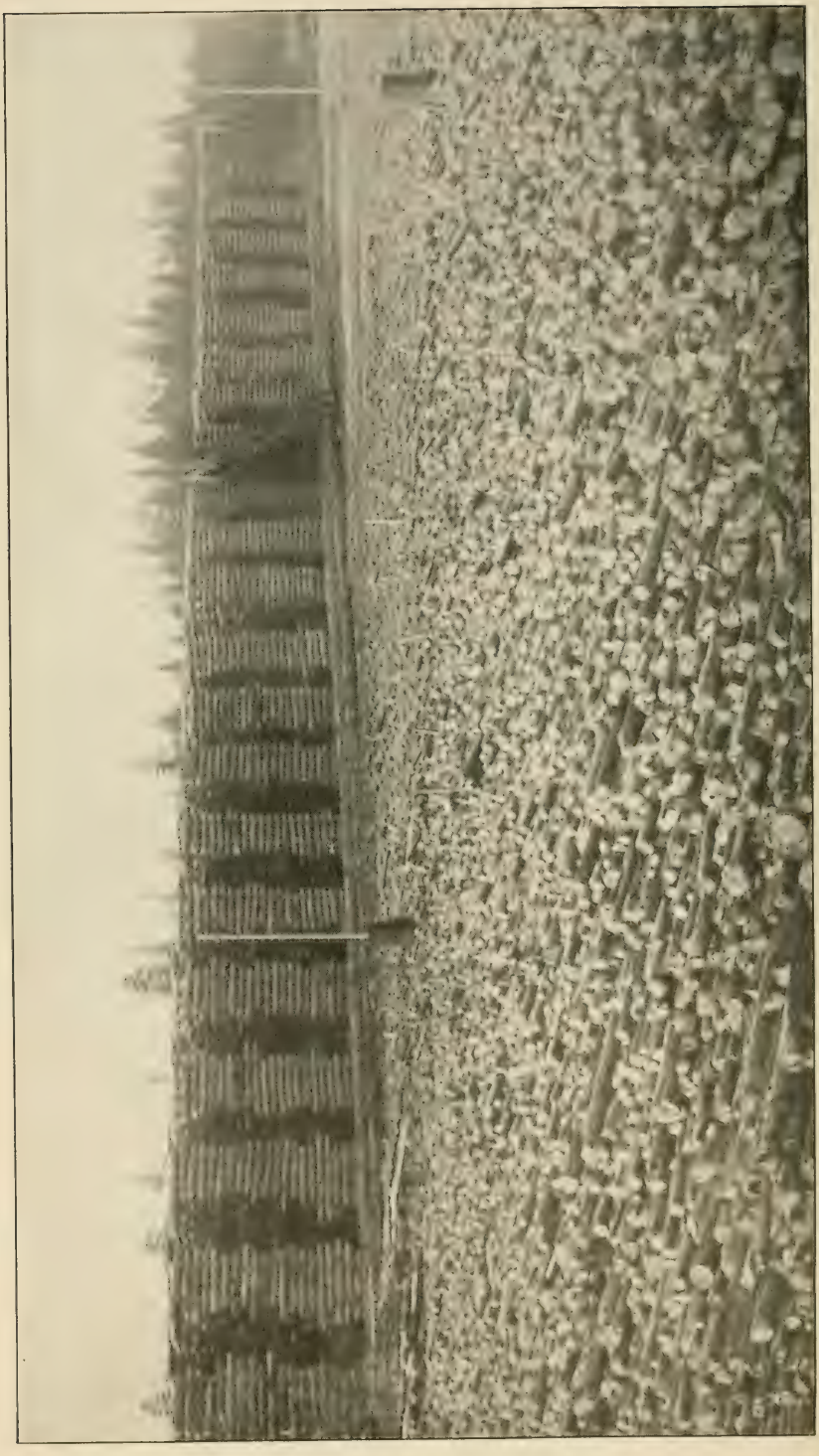


FIG. 49.—TWO SYSTEMS OF STORING LOGS.

must be sawn in such a way that the saw blades cut parallel with the shakes. The top diameter upon which the sawing schedules are based in this case is therefore smaller than in the former case, and lumber of smaller widths is produced. For instance, perfect oval logs $7\frac{1}{2}$ inches in minimum top diameter can produce lumber $2\frac{1}{2}$ by 7 inches; but if the logs are shaky, $7\frac{3}{4}$ inches in minimum top diameter is necessary to produce the same size of lumber.

(2) *Quality.*—The sawing schedules often contain special instructions in regard to the sawing of the different qualities of logs and these schedules are made to conform to the grading stipulations. If,

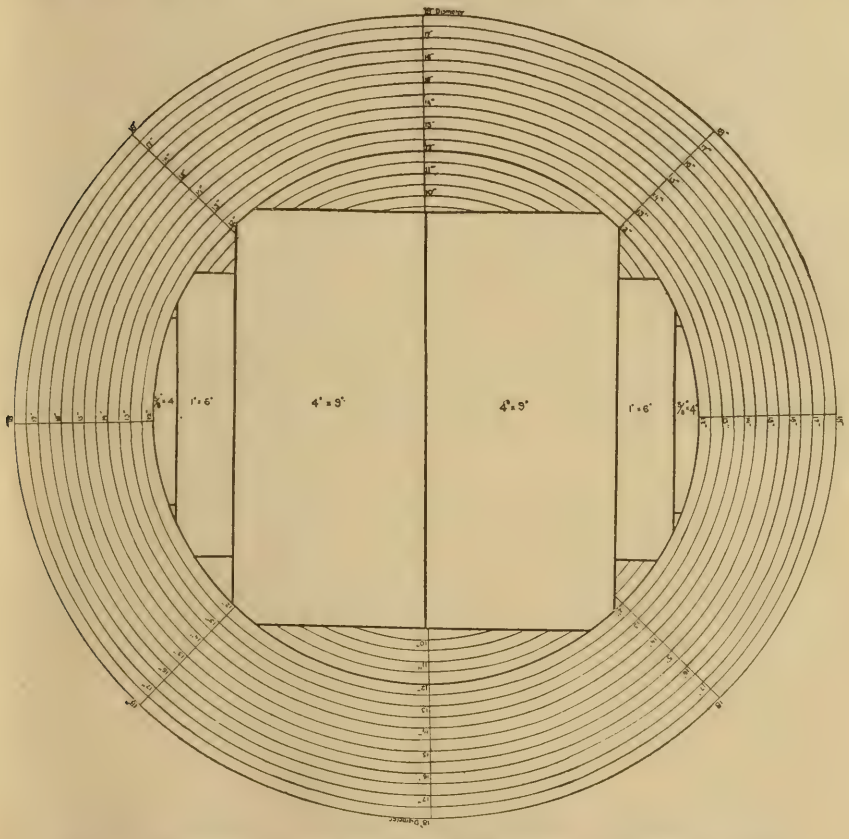


FIG. 50.—Sawing system passing logs once through the gang saw (top diameter, 12 inches).

for instance, logs that yield only cull lumber are sawed practically square-edged, it is evident that a serious loss of material will be the consequence, as cull lumber admits of a large amount of wane. The following example illustrates this point. In order to obtain a piece 3 by 9 inches, of first quality, the top diameter of the log must not be smaller than $12\frac{1}{4}$ inches, while the same dimension of third quality may be produced from logs 12 inches in top diameter and fourth quality from logs $11\frac{3}{4}$ inches in top diameter.

(3) *Lengths.*—Short lengths may be sawn on a different schedule from standard lengths on account of the difference in taper.

It is seen that the log scaler has an important position, and that carelessness in his work may cause heavy losses to the mill.

Two different methods of sawing are used in most of the Swedish mills working on an efficient basis: (a) Passing logs once through the gang saw and (b) passing logs twice through the gang saw.

The former system involves a lower labor cost, but each piece of lumber must be edged separately in the edger. This is used only for small logs $4\frac{1}{2}$ to 7 inches in top diameter. Logs of larger top diameter are usually passed through the gang twice. By this system the

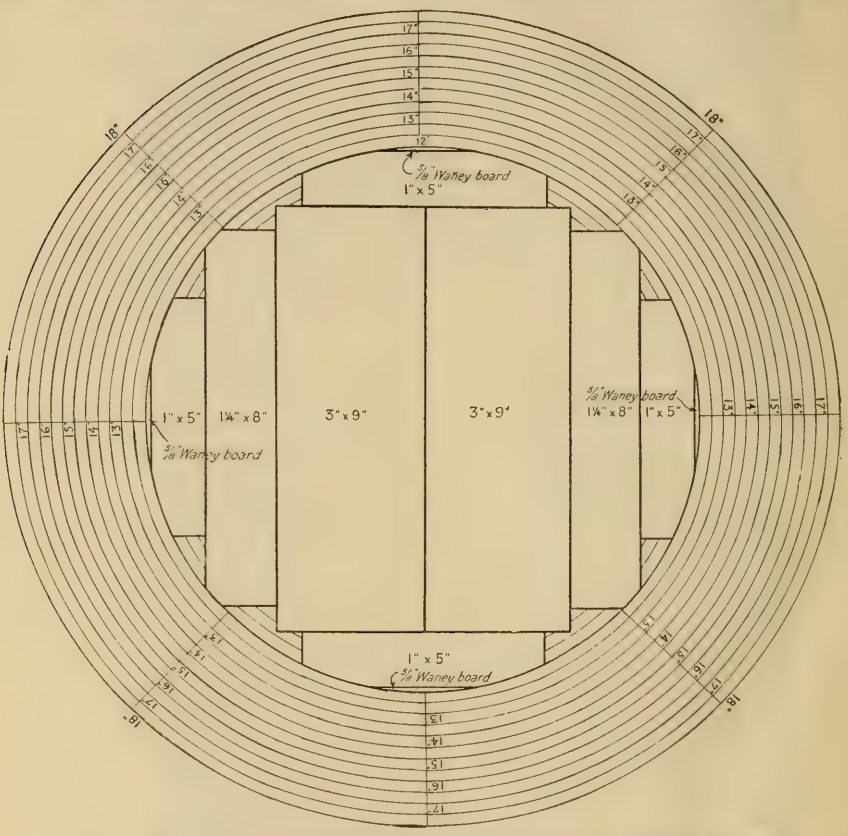


FIG. 51.—Sawing system passing logs twice through the gang saw (top diameter, 12 inches).

first gang slabs two or three boards on two sides of the log. The log is then turned over 90 degrees and passed through the next gang, located immediately in front of the first gang, and the lumber is cut to the required dimension. The lumber produced by this method is almost square-edged and only a small percentage of it passes through the edger. Much material can be saved by the latter method, because the edging of the lumber is done by the first sawing in the gang and not in the edger. Thus waney boards are obtained, which have a higher market value than edgings. The material utilized is about 10 per cent more than by the first method, but the cost of sawing is considerably higher, because it requires about 75 per cent

more time to pass the logs twice through the gang saw. In addition, the average length of the lumber sawn by passing the logs twice through the gang is materially increased.

It is a matter of easy calculation to the Swedish mill operators to decide which method pays the best in each case. The cost of labor may be high but the increased saving of material amply offsets the extra expenditure for the more careful sawing system. Many mills in Sweden therefore base their entire production on passing all logs twice through the gangs. The system has its drawbacks, however, because the amount of wane can not be regulated easily, as practically all the lumber is sawn square-edged, except the sap boards. This method, therefore, is not profitable in cutting low-grade logs.

The following sawing schedule, procured from a Swedish authority on the subject, shows the dimensions and the cubical contents of lumber obtained from a log 18 feet long and 12 inches in diameter, containing 14.14 cubic feet: When the log is passed once through the gang saw, the dimensions obtained are five-eighths of an inch by 4 inches, 1 by 6 inches, 4 by 9 inches, 4 by 9 inches, 1 by 6 inches, and five-eighths of an inch by 4 inches, the aggregate cubical contents of which is 11.13 cubic feet, not trimmed, or 9.46 cubic feet, trimmed; when the log is passed twice through the gang saw, the dimensions obtained from the first gang are five-eighths inch waney board, 1 by 5 inches, 1 by 5 inches, and five-eighths inch waney board, and from the second gang, five-eighths inch waney board, 1 by 5 inches, $1\frac{1}{4}$ by 8 inches, 3 by 9 inches, 3 by 9 inches, $1\frac{1}{4}$ by 8 inches, 1 by 5 inches, and five-eighths inch waney board, the aggregate cubical contents of which is 11.44 cubic feet, not trimmed, or 10.64 cubic feet, trimmed.

The difference in the cubical contents of the lumber produced by these two systems may be still greater in some cases.

The sawing of odd sizes on special orders requires unusual skill on the part of the sawyer because salable lumber must be produced from the rest of the log; otherwise the mill finds itself with many other odd dimensions, for which there is no market. Comparatively few mills make a profit on sawing odd dimensions unless they specialize in it. This is especially true at the present time, with the high cost of labor, because the sawing of such stock involves extra expenditures, which in many cases are not offset by the extra prices paid.

In selecting the sawing schedule, attention is usually paid to having the center of the logs cut by the saw blade, except in the case of scantlings, which are usually cut from top logs. Otherwise, the lumber is liable to become shaky while drying. Many mills, however, contend that it is not necessary to have the center cut by the saw blades if the lumber is properly piled and seasoned.

A Swedish authority on sawing schedules (O. Ericson) has issued a table showing the different top diameters of saw logs, accompanied by a set of patterns representing the usual stock sizes of lumber for export. By this system, called "the Ericson system," the mill operators can easily prepare their own sawing schedules and find out in advance how to saw the logs in the most profitable way without waste by trial sawing, etc. This system is of special value in cutting odd sizes. It is used throughout Sweden and also in Finland and Norway.

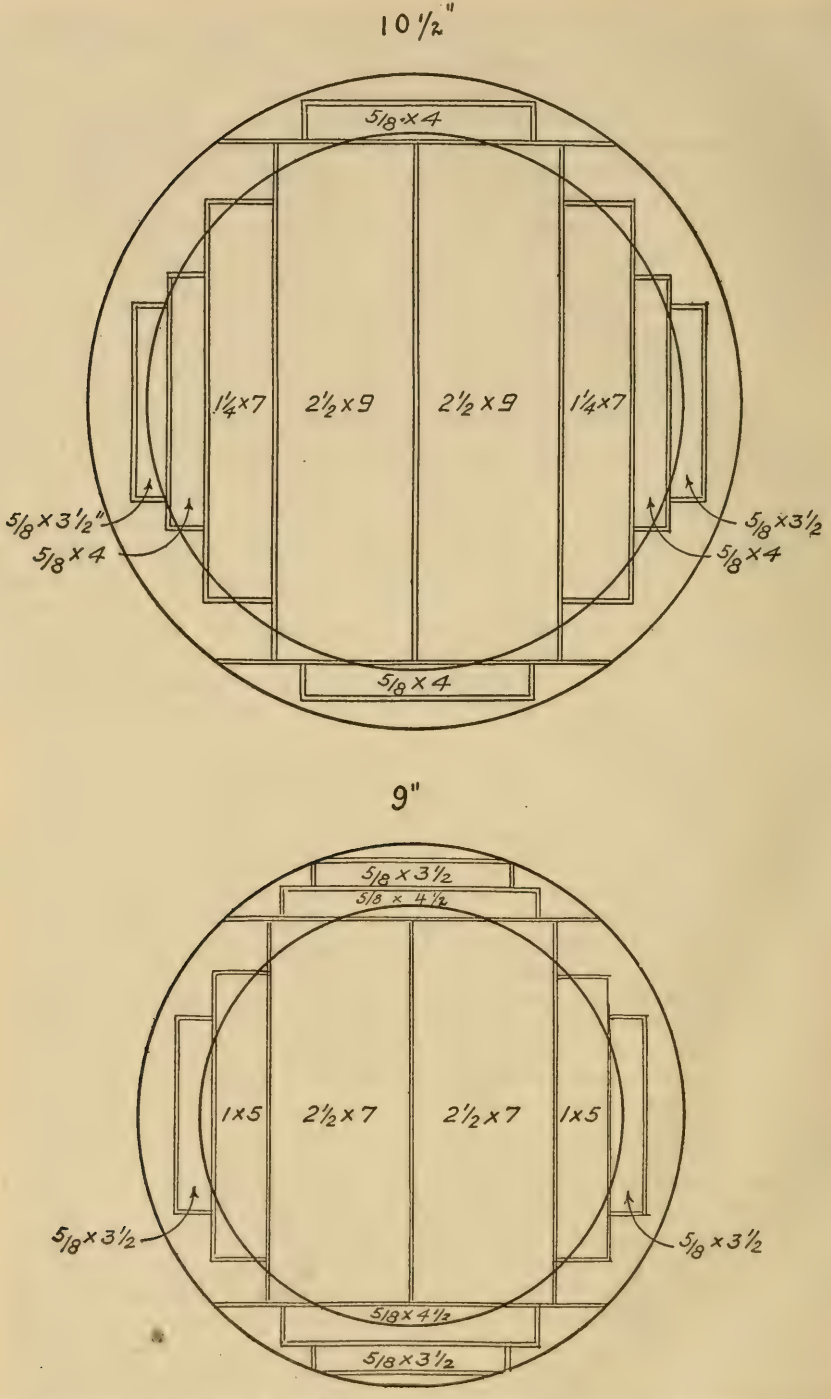


FIG. 52.—Sawing schedules for logs 10½ and 9 inches in top diameter. The inner circle represents the top circumference and the outer circle the butt circumference of the log.

Crooked logs are sawn on special gang saws, such as were previously described. The bend of the logs generally must not exceed 4 inches on an average standard log of 18 feet; i. e., the deviation of the log axis from a straight line must not exceed 4 inches. Lumber from such logs is piled with the bend up so that only the ends of the pieces touch the underlying lumber. By the weight of the lumber piled on top, it is claimed that the crook disappears by the time the lumber is sufficiently dried for shipping.

Complaints have been heard from time to time from customers abroad in regard to such lumber, but these complaints may be due to the defective piling system used; opinion on this point differs considerably among Swedish mill owners. There is no question that the saving in material by sawing crooked logs on special gangs is considerable; it may be, in some cases, as high as 40 to 50 per cent, it is claimed.

Furthermore, the average length of the lumber is materially increased because mills not having special gangs for sawing crooked logs must crosscut the crooked logs and produce short lumber. Crooked logs sawn on ordinary gang saws produce a larger percentage of mill ends than those sawn on special gangs.

The lumber is cut to English measurements in thickness and width; the sawing according to other measurements is so rare that it may be left out of consideration. It must be noticed, however, that it is easy for the Swedish gang saws to be adjusted to cut to any measurement; but the handling of lumber cut to many different standards would cost the mills a great deal of extra trouble and this is why such cutting is rare.

In all sawing schedules adequate allowance is made for shrinkage, but this allowance varies a great deal in the different parts of the country, depending upon the climatic conditions, the character of the logs, the rate of growth, and whether or not the logs are floated. It is therefore almost impossible to give any general rule to cover the sawing schedules in all parts of Sweden. It is generally held that the gang saws are set to cut to Norwegian inches and that the lumber will dry out to English inches. (Norwegian inches are about 3 per cent larger than English inches.)

The following figures, prepared by Forester W. Ekman, show the customary allowances for shrinkage that are made in sawing lumber: $\frac{5}{8}$ and $\frac{3}{4}$ inch thickness—$\frac{2}{64}$-inch excess; 1 and $1\frac{1}{4}$ inch thickness—$\frac{4}{64}$-inch excess; $1\frac{1}{2}$-inch thickness—$\frac{5}{64}$-inch excess; 2 and $2\frac{1}{2}$ inch thickness—$\frac{6}{64}$-inch excess; 3 and 4 inch thickness—$\frac{8}{64}$-inch excess; 4 and $4\frac{1}{2}$ inch width—$\frac{8}{64}$-inch excess; 5 and $5\frac{1}{2}$ inch width—$\frac{10}{64}$-inch excess; 6 and 7 inch width—$\frac{12}{64}$-inch excess; 8, 9, and 10 inch width—$\frac{14}{64}$-inch excess; 11 and 12 inch width—$\frac{16}{64}$-inch excess.

The lumber is passed from the gang saw to the edger on conveyors.

EDGING, SORTING, AND TRANSPORTATION.

The edgerman is one of the most important operators in the mill. He must know the grades and the wane permissible in the different grades and how to produce the maximum width in each piece of lumber, taking into consideration what dimensions are in demand and how to obtain them without sacrificing the width of the balance of the stock. It is easy to understand the importance of having a

capable edgerman when it is considered that the difference in price per 1,000 feet board measure between 9-inch and 11-inch stock is at present $10 to $12. By careless edging thousands of dollars may be lost, and many mills contend that the edgerman to a great extent decides the profit which the mill is making.

The lumber is generally edged on the half inch, starting from 3 inches and going up to 7 inches. For wider stock the lumber is usually edged on odd and even inches. The edging of two pieces at one time is never seen in standard mills because each piece of lumber must have the edgerman's individual attention, even if it requires a little longer time to do the work in this way. Stock destined for planing purposes is given an unusually large amount of wane. The reason for this will be given in a later chapter. It can not be too strongly emphasized in connection with Swedish sawmilling that careful utilization of the raw material is given the first attention and that speed is secondary. The careful edging of the lumber in Sweden is striking compared with the practice in many other wood-producing countries. Swedish lumbermen who have visited other countries often comment unfavorably upon the practices, for instance, in Austria, where the edging is left to the cheaper class of labor and usually to women, who are not physically qualified for the work.

The lumber coming from the edger may be roughly trimmed in the mill on balanced circular saws, but only in cases where the ends are extremely rough. The exact trimming of the stock is not effected until the time when shipment is made.

From the edger the lumber is transported on belts or live rollers to the sorting plant located immediately outside of the mill. In this sorting plant the lumber is roughly separated into the principal grades and sizes. In the most up-to-date plants the lumber is transferred to the various sorting tables by a system of switches operated from the mill, which reduce the handling to a minimum. The sorting plant is built on the same level as the upper sawmill floor and the lumber is lowered on chutes to cars immediately below each sorting table. These cars are then transported to the yard either by electric engines or by horses.

The transportation question in the mill has not always been handled in the same efficient way as at present and many old sawmills experience considerable trouble in having the mills modernized in this respect.

DIMENSIONS.

Each mill has usually one or several customers abroad demanding special stock, but certain sizes are cut by nearly all the mills, such as 3 by 9 inches, 2½ by 7 inches, 1 by 4 inches. The following are the dimensions of pine and spruce for export that are most in demand and are considered as stock sizes: 4 by 11 and 9 inches; 3 by 11, 9, 8, 7, 6, 4½, and 4 inches; 2½ by 11, 9, 8, 7, 6½, and 6 inches (2½ by 9 and by 8 inches being spruce only); 2 by 11, 9, 8, 7, 6½, 6, 5½, 5, 4½, and 4 inches; 1½ by 11, 9, 8, 7, 6, 5, 4½, and 4 inches; 1¼ by 11, 9, 8, 7, 6½, 6, 5½, 5, 4½, and 4 inches; 1 by 11, 9, 8, 7, 6½, 6, 5½, 5, 4½, 4, 3½, and 3 inches.

Other dimensions usually produced are the following: 4 by 8, 7, 6½, 6, 5, and 4 inches; 3 by 6½, 5½, 5, and 3 inches; 2½ by 5½ and 5 inches; 2 by 3½ and 3 inches; 1½ by 5½, 3½, and 3 inches; 1¼ by 3½

and 3 inches; $\frac{7}{8}$ by 7, $6\frac{1}{2}$ 6, $5\frac{1}{2}$, 5, $4\frac{1}{2}$, 4, $3\frac{1}{2}$, and 3 inches (all $\frac{7}{8}$-inch sizes for spruce only); $\frac{3}{4}$ by 7, $6\frac{1}{2}$, 6, $5\frac{1}{2}$, 5, $4\frac{1}{2}$, 4, $3\frac{1}{2}$, and 3 inches; $\frac{5}{8}$ by 7, $6\frac{1}{2}$, 6, $5\frac{1}{2}$, 5, $4\frac{1}{2}$, 4, $3\frac{1}{2}$, and 3 inches.

In addition to these dimensions, there may be many others, such as, for instance, 12-inch stock, but not many mills can cut 12-inch lumber because their logs are too small.

The demand from one year to another may vary considerably. It depends upon the demand in the different countries and the ability of other competing countries to furnish the material. Russia, for example, furnishes a large percentage of Europe's demand for planks and when this country was unable to make deliveries, the importers turned to Sweden and other north European countries to supply this commodity. Some markets may demand large quantities of planks (for instance, the British colonial markets), while other countries, such as Germany, specify boards and battens. The stock kept on hand depends upon the markets to which a mill caters. It is also very important that the sales manager of the mill ascertain in advance of each cutting season what dimensions would be most in demand in order to adjust the cutting in the mill. There is, therefore, nothing haphazard about the Swedish cutting for stock.

There are a larger number of dimensions of pine than of spruce. Ten-inch stock is generally not much in demand, except in a few markets, while 11 inches and 9 inches are stock sizes. The mills' ability to cut 9-inch and 11-inch stock is somewhat limited by the small log dimensions. Usually the quantity of 11-inch stock does not exceed 3 to 5 per cent in most of the mills. Before the war there was a growing demand in Sweden for seven-eighth-inch and nine-eighth-inch boards, and many mills included these in their regular stock lists. Limited quantities of one-half-inch boards may also be cut at times. Most of the mills carry three-fourth-inch and five-eighth-inch boards in stock.

The following schedule is representative for some of the larger export mills in Norrland, showing the percentages of the different widths of lumber produced:

Widths.	Pine.	Spruce.	Widths.	Pine.	Spruce.
	Per cent.	*Per cent.*		*Per cent.*	*Per cent.*
9 inches and wider	19	12	$5\frac{1}{2}$ and 5 inches	17	27
8 inches	12	8	$4\frac{1}{2}$ and 4 inches	16	26
7 inches	17	12			
$6\frac{1}{2}$ and 6 inches	19	15	Total	100	100

In other parts of the country the percentage of wide stock is much smaller.

Swedish lumber for export is divided into the following categories: Planks—2 inches in minimum thickness and $8\frac{1}{2}$ inches in minimum width; battens—2 inches in minimum thickness and 6 to $8\frac{1}{2}$ inches in width; scantlings—2 inches in minimum thickness and less than 6 inches in width; boards—less than 2 inches in thickness and 6 inches or more in width; narrow boards—less than 2 inches in thickness and less than 6 inches in width. The Swedish mills usually produce approximately the following percentages of each category: Planks, 17 per cent; battens, 20; scantlings, 10; boards, 25; narrow boards, 28.

The quantity of small dimensions of lumber, such as staves, broom handles, and similar stock, usually does not exceed 20 per cent of the total quantity produced and in many cases it is only 8 to 12 per cent.

Planks are sometimes resawn in the mills into several thicknesses, leaving about 6 inches at the end of the plank which is not cut by the resaw. This stock is sometimes shipped to certain markets in Africa, as it is claimed that the duty on lumber is based on the number of pieces and by cutting the stock in this way the duty is only paid on one piece. This procedure, however, is not very often followed.

On account of the small dimensions of the logs, practically no rift (vertical) grain is produced. Heart specifications are filled by only a few mills, mainly for railroad and ship material; but the output of this commodity is so limited that it may almost be left out of consideration. Most of the mills do not attempt to cut such stock.

SPECIAL PRODUCTS.

PAVING BLOCKS.

From only one district in Sweden is paving-block material being supplied. Swedish pine is usually too soft to make an entirely satisfactory paving block, but the district of Norrkoping, immediately south of Stockholm, has made a specialty of it. Planks 3 by 9 inches and 3 by 8 inches are used for this purpose abroad, but blocks are seldom manufactured in Sweden.

There is no doubt that material obtained from the district of Norrkoping would give a fairly satisfactory paving material and could be successfully introduced in many countries if the exporters from this district were willing to make the necessary effort to push this article. In several cities in Sweden such paving material has been found suitable, and there is no reason why it should not obtain as good a result in foreign markets. The Norrkoping paving-block material is denser than the *Pinus maritima* of southwestern France, which is used extensively for paving blocks in southwestern Europe.

SHORT LUMBER.

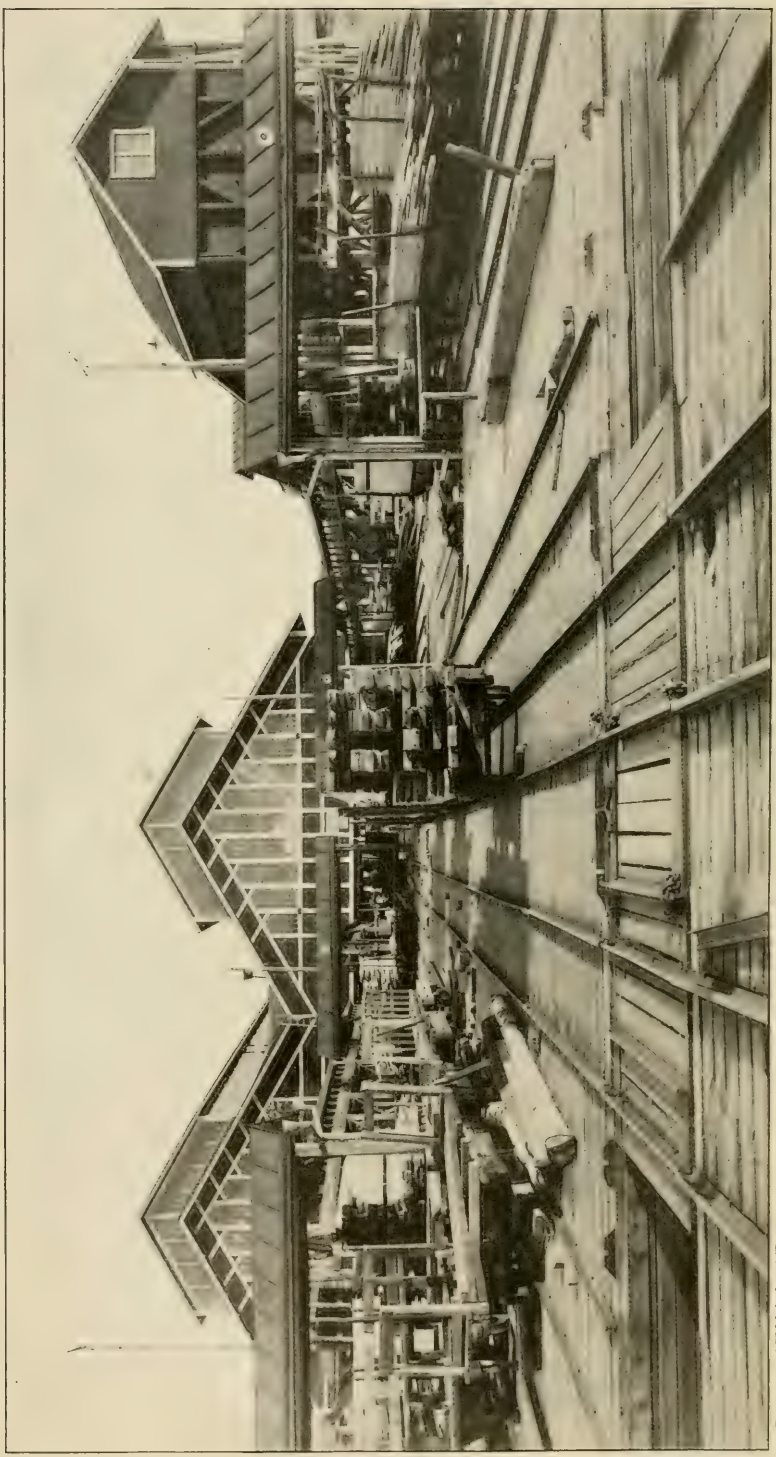
Short lumber is considered stock in lengths of 6, 7, and 8 feet. Of this stock there is never an excessive quantity in Sweden of which the mills can not dispose. The proportion of short lengths seldom exceeds 7 per cent for ordinary stock, but it may be as high as 20 to 22 per cent for narrow sap boards. As these boards are generally fairly clear, however, they nearly always find a good market. In all ordinary contracts for export, there is a clause to the effect that 3 to 5 per cent of short lengths must be included in each cargo at a certain reduction in price. In this way the Swedish exporters have been enabled to dispose of most of their short lumber, and whatever excess quantity is found on hand may be utilized for other purposes.

STAVES.

Staves are manufactured into various sizes, according to the use and destination. This stock is generally cut for cement and herring containers which are made of both pine and spruce. The usual dimensions of staves are as follows: One-half inch thick, 3 to 7 inches

Courtesy of Uddeholm A/B.

FIG. 53.—LOG POND.



Courtesy of Uddeholm A/B.

FIG. 54.—MODERN SAWMILL.

wide (small quantity, 2 inches), 24, 26, 28, 29, and 32 inches long, and heading 17 to 18 inches long. Sometimes they are nine-sixteenths inch thick, 24 inches long, and 2½ to 4 inches wide or five-eighths inch thick, 30¼ inches long, and 2½ to 4 inches wide. The staves are always cut square-edged and must be of good, sound quality.

BROOM HANDLES.

Broom-handle stock is cut of both pine and spruce, 1 by 1 inch and 1, 1.25, 1.40 to 2½ meters (1 meter = 3.28 feet); 1¼ by 1¼ inches and 1, 1.25, 1.40 to 2½ meters. In Sweden broom handles for export generally are not turned but are shipped in squares, because these broom handles would require expensive packing boxes, and the prices are so low that it would not pay the Swedish exporters to turn out this stock.

LATH.

Lath is manufactured from both pine and spruce in the following dimensions: 1¼ by 1¼ inches, 1⅛ by $\frac{3}{16}$ inches, 1 by 1¼ inches, 1 by $\frac{3}{16}$ inch, etc., in lengths of 2½, 3, 3½, 4, 4½, and 5 feet. The lath must be free from knots and accurately sawn.

CHARCOAL.

Charcoal is an important product in Sweden; at least 10 per cent of all wood cut is manufactured into this commodity. The value of the charcoal produced in 1913 was approximately $7,500,000, but this figure includes charcoal made in the woods, at the sawmills, and in special plants. During the war the price for charcoal increased about 300 to 400 per cent above the pre-war figures and this caused many mills to increase their production of this commodity. Even old buildings were torn down to be converted into charcoal. In the future it is believed that the charcoal industry will somewhat decline, as the electric smelting of ore will probably be further developed.

UTILIZATION OF SAWMILL WASTE.

Even in the most efficiently operated mills, there is always a considerable percentage of slabs, edgings, etc., and without close utilization of this refuse it is not possible for the sawmills to operate at a profit. A variety of small-dimension lumber can be cut from such waste material. Among the principal kinds are staves, box shooks, broom handles, laths, and molding stock. In some plants special mills adjoining the sawmills have been constructed for cutting this stock. Outside of the mill, charcoal plants are frequently constructed for the utilization of slabs and edgings that would not be suitable as raw material for small-dimension lumber.

Waste that is not suitable for other purposes is often chipped in logs to make raw material for the pulp mills, or it may be trimmed to standard lengths for firewood. Some mills have automatic trimmers for this purpose.

During normal times coal costs about $4.50 to $5 per ton, but its price increased during the war to about $65 to $80 per ton. Evidently the value of the sawmill refuse would show a corresponding increase.

It is calculated that about 430 cubic feet of sawmill refuse (edgings, etc.) is equal to 1 ton of coal and that about 650 cubic feet of sawdust

will give the same equivalent. If the price of coal is $4.08 per ton the value of the sawmill refuse would be approximately $1.03 per ton. If the price of coal is $8 per ton, the value of the refuse would be $1.60 per ton. If the price of coal is $13.50, the value of refuse would be approximately $3.50 per ton, and so on. The value of refuse is calculated net; that is to say, due allowance is made for the transportation from mill to power plant and extra expenses in the handling of refuse in firing.

The price of sawmill refuse cut into chips for pulp making varied considerably in price before the war, but as a rule it was 6 cents to 8 cents per cubic yard in 1913. In 1918 as much as $1.65 per cubic yard was paid for this material.

In Goteborg, the price for mill ends used for fuel in that city was higher than in any other part of the country; in 1918 as much as $4 per cubic yard was paid for this material.

In some plants sawdust is compressed into briquets on special machines, using wash waste from the pulp mills as a binder. The moisture content of these briquets is about 15 per cent.

Sawdust may also be ground into wood flour, used in the manufacture of various articles, including gramophone records and linoleum. Sweden's best market for wood flour (usually made of spruce) is the United States. Exports of this product to the United States have been increasing rapidly and amounted to more than 6,000,000 pounds, valued at $32,000, in 1916.

In passing through a standard Swedish mill one is struck by the absence of rubbish. The present generation has not seen any refuse burners in Sweden.

SEASONING.

AIR-DRYING.

Most of the standard mills in Sweden have extensive yards and their system of seasoning has a world-wide reputation. The size of a Swedish yard may differ considerably according to locality. In the north the yards must be capable of storing a larger percentage of the annual production than the mills in the southern sections of Sweden. While the mills on the west coast can ship throughout the year, the mills in the extreme north must always count on having large stocks on hand on account of the limited time during which navigation is open. On an average, it may be said that the capacity of a yard should be at least one-third of the annual production of the mill, but some mills have storage capacity for up to two-thirds of their annual production.

The country is flat at the coast and it is usually easy to find an open space convenient for laying out a yard with suitable dock facilities, etc. The yards were formerly reclaimed by filling in sawmill refuse, but during the war the sawmill refuse was so valuable that several mills removed the filling, turning it into raw material for the pulp factories, and put sand in its place. Sand is considered more suitable than sawmill refuse, because the lumber is liable to be discolored when piled on decayed sawmill waste.

As a rule, large yards are provided with a rail system and many mills have electric locomotives for transporting lumber from the mill to the yard. The rail system may be laid on the ground or may be elevated above the ground. The latter system is expensive and

it is claimed that the elevated-rail system to some extent prevents ventilation in the yard and that the lumber is liable to discolor more easily than if the rails are laid on the ground. On the other hand, the elevated-rail system has many advantages. The lumber is more easily handled, because it is lowered to the ground on special apparatus and this operation does not require any special skilled laborers such as are needed with the other system where the lumber has to be carried on the shoulder 20 or 25 feet up on top of the piles. The labor situation has been difficult for some time.

Many mills also have electric cranes, automatic stackers, and other similar devices for piling lumber. The cranes are usually considered the most satisfactory. Piling with mechanical devices often reduces the cost of the operation by 50 per cent.

Characteristic of the better Swedish yards is the high base of the piles, usually 2 to 3 feet from the ground. This base is frequently built up of mill ends in the shape of a pyramid having open spaces between each layer of the mill ends, so that the ventilation will be satisfactory. The piles rest either on sand or on a solid wooden floor. A great deal of attention is paid to keeping the base of the piles perfectly clear of rubbish and other matters that are liable to decay and thereby cause the lumber to discolor.

The piles are generally about 25 feet wide and up to 29 or 30 feet long and 20 to 22 feet high, and they contain 40,000 to 45,000 feet board measure of lumber (planks). They are covered with roofs and in cases where the yards are equipped with cranes the roof boards are nailed, which makes the placing of the roof on the piles less troublesome. In the better yards, the piles often have triple roofs, so that the joints overlap and the piles are kept absolutely dry.

The following schedule gives the number of tiers of the different dimensions in the piles generally seen in Sweden: 4-inch thickness, 14 to 16 tiers; 3-inch thickness, 18 to 20 tiers; 2½-inch thickness, 28 to 30 tiers; 2-inch thickness, 40 to 45 tiers; 1½-inch thickness, 55 to 60 tiers; 1¼-inch thickness, 65 to 70 tiers; 1-inch thickness, 85 to 90 tiers; ¾-inch thickness, 115 to 125 tiers.

From the top of the pile to the top of the roof there is generally a distance of about 28 inches. Sometimes it is necessary to have the stock seasoned quickly and the lumber is piled

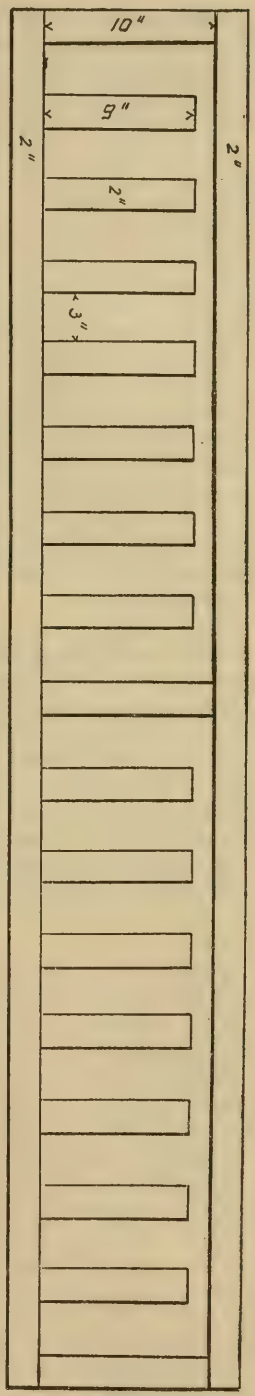


FIG. 55.—Diagram of piling method.

on edge, with 30,000 to 35,000 feet board measure in the pile. It is also claimed that lumber when piled in such a way that the ends are projecting from 3 to 4 feet from the piles without having any support will dry more rapidly, as the circulation of air is more satisfactory. Lumber piled in this way, however, is liable to split at the ends.

In one case a very practical arrangement was seen of such piling. A pile containing, for instance, 3 by 9 inch planks was piled in such a way that in each tier one piece 3 by 10 inches was placed at each end and one piece in the middle and between these pieces the 3 by 9 inch planks were stacked on edge. Other tiers were placed on top of the first tier in the same way. (See fig. 55.) When the lumber was dry, the 3 by 9 inch planks could easily be shoved together and piled solid without having to take down the whole pile and repile it again. It was furthermore seen that these piles dried somewhat quicker than other piles where the tiers contained one dimension only, because by this system of mixing 3 by 10's and 3 by 9's a more even circulation of air was obtained. After the lumber stacked on edge is dry, it is piled solid and the piles contain about 80,000 to 100,000 feet board measure per pile.

In the yards, the lower grades and the spruce lumber are piled at the center and the better grades and pine lumber are piled at the outskirts of the yard, because pine lumber is more liable to discolor than spruce.

Some mills have sheds for the upper grades. In the better Swedish yards a great deal of care is given uncovered piles by protecting them with tarpaulins. The same applies to trucks of lumber left in the yard during rain or overnight. As Swedish lumber is not sold on specified lengths, all lengths are mixed in the piles, but each pile contains one dimension in regard to thickness and width and one grade only. The piles are not given a sloping shape, as is common in the United States, but are built on a horizontal foundation. Often the piles containing the upper grades of lumber are covered on one or on all four sides with weatherboards to protect them from the elements.

It was particularly noticed in Sweden how careful the exporters are in storing lumber left over from one season to another on account of the inability of the importers to obtain tonnage. Either no charge is made for such storage or the charge is very small, but such lumber is stored at the owner's risk.

The lumber is considered sufficiently dry for shipment when it contains approximately 30 per cent of moisture.

In the northern parts of Sweden the snow during the wintertime causes extra work in keeping the alleys and the roads open. From the yard to the dock the lumber is transported on a system of conveyors provided with live rollers and operated by electricity. There is generally a conveyor for every other aisle in the yard. Some mills have a system of sectional conveyors that can be moved from one aisle to another, but it is generally found that the stationary conveyors give better service in the end, although they cost more in construction. There are, of course, many smaller yards that do not have conveyor systems and take the lumber to the dock on trucks, but the larger mills all transport their lumber in the way described.

In regard to the time which the lumber requires to be seasoned, it is impossible to give any general rule, as the conditions in the different yards, even in the same districts, vary considerably.

The following table, however, shows figures compiled by O. Ericson for the length of time allowed for seasoning lumber sawn at different seasons and shipped to different destinations. These figures are believed to be fairly representative of Swedish conditions in general.

Countries of destination.	Sawn during autumn.	Sawn during winter.	Sawn during spring and summer.	Countries of destination.	Sawn during autumn.	Sawn during winter.	Sawn during spring and summer.
	Months.	*Months.*	*Months.*		*Months.*	*Months.*	*Months.*
Denmark and Germany	8	4	2	Southern France	8–9	4	2½–3
United Kingdom and Netherlands	8	4	2	Spain and Portugal	8–9	4	2½–3
Northern France	8	4	2	British colonial and other over-sea markets	9–10	6	4

From this table it is seen that the lumber must be given special care when it is destined for far-away countries, and exporters contend that such care is well worth while. The passage to these countries often lasts a month or more, and if the lumber is put on board improperly seasoned it is liable to discolor. The importers take the same stand and contend that the small extra charge that they have to pay for this careful handling of the lumber is well worth while, because it is insignificant compared with the total cost of the lumber delivered at its destination.

Owing to the careful seasoning of the lumber, the percentage of discolored stock is very small in Sweden. Many mills do not figure on a larger percentage of discolored stock than 1 per cent, and in some cases even less was reported. The maximum seemed to be 10 to 12 per cent, and in such cases it was frequently found that the logs had been floated for two years and that the discoloration had occurred before the lumber reached the mill. The discolored lumber is frequently passed through the planing mill, and the discoloration partly disappears. The mills are unwilling to include discolored stock in large quantities in the regular stocks of rough lumber for export.

KILN-DRYING.

Although the system of kiln-drying has been known for years in Sweden, it can not be said to have come into general use. In the first place, the American methods introduced some time ago did not work out very well in Sweden, principally because no consideration was given at that time to the different character of Swedish and American lumber. However, during late years successful experiments have been carried on in Sweden, and it is said that at least one firm has perfected a system of kiln-drying and used it successfully.

At present only a small number of mills in the country kiln-dry their entire output. Where kilns are found they are generally worked in connection with planing mills or box factories.

The advantages of kiln-drying lumber are not so evident in Sweden as they are in the United States. Whereas in the United States fuel is very cheap, because the value generally placed on refuse is almost nil, in Sweden the value of refuse as a fuel or material for pulp making is very high because the country has no coal deposits of its own and is dependent upon imports for this commodity. Further-

more, the principal shipping ports in Sweden can not ship throughout the year. Therefore, the lumber must be seasoned in the cheapest way—by air-drying.

On the other hand, the Swedish exporters realize the advantages of kilns, which would enable them to insure their customers quick delivery and also to complete a cargo on short notice, if a shortage should be discovered at the time of shipment. This last advantage is not so striking in Sweden, because if one mill is short of stock the other mills are usually willing to help out.

For box factories and planing mills, which require lumber containing about 25 per cent of moisture, kilns would be of good service.

As far as could be learned, customers abroad have not objected to kiln-dried lumber. Nevertheless it can not be denied that kiln drying in some parts of Sweden would have limited prospects of success. In certain sections of Sweden the logs are taken from mountainous districts and the lumber is very knotty. Around most of the knots there is a pitch ring, and when such lumber passes through the kiln, the knots are liable to fall out. If, however, the plans of the Norrland lumbermen to keep navigation open by ice breakers during several months in the winter should be realized, kilns may have a better chance.

GRADING.

There is no absolutely uniform system of grading in Sweden. Each mill has established grades to which it adheres closely year in and year out. The grading rules established for each mill have often been created by cooperation between buyers and sellers and they are usually made up in such a way so as to suit particular markets. It often happens that mills with large stands of virgin timber have been able in years past to supply comparatively large quantities of the upper grades. During late years, these concerns may have partly cut out these old stands and the second-growth timber may produce only small quantities of the upper grades. In such cases the grading rules are not made less strict to conform to the new conditions; the cutting out of the old stands only decreases the quantity produced of lumber of the upper grades, according to the old-established grading rules. This is one of the basic rules of the Swedish lumber export trade and is the reason why the exporters have been able to maintain the same markets for decades. The importers may complain at times because they are unable to obtain as large quantities of one grade or of several grades as they did in previous years, but these complaints do not induce reliable Swedish shippers to make the grading rules less strict by including inferior qualities in the upper grades.

During late years there has been a tendency toward a more uniform system of grading in some districts in Sweden. This may be caused by the fact that several individual mill owners have reorganized their concerns into stock companies.

It was formerly a matter of pride to many exporters to be able to supply a better grade than their neighbors, and there are still a few firms in Sweden that prefer to include only first, second, and third grades in their unsorted grade, while all other firms are including first, second, third, and fourth grades. The former firms may obtain a slightly higher price than the latter firms, but this is no doubt a

poor policy because by "sweetening" the grades they lose out in the end on the profits realized on the whole production. The only benefit to exporters from these practices may be that they obtain a reputation for shipping above grade, but this is not considered good business. As these firms pass over into stock companies, the matter of grading rules is often adjusted to conform to the usual practices of grading in the particular district where they are located.

Thus the different grading rules are based to a large extent on conditions of past years, which now have partly ceased to exist, such as the possession of old stands allowing a larger percentage of clear lumber than lumber cut from second-growth forests, etc. As these forests are gradually cut out, the production of the various sawmills is made more uniform, thereby paving the road for a uniform grading system for the different districts. This matter has already been given consideration in Sweden and no doubt will be taken up seriously. A branch of the Swedish Exporters' Association in the Hernosand district appointed a commission some years ago to establish uniform grading rules for all the association members in that district. An abstract of these rules is given at the end of this section. Uniform grading rules for the entire country probably would not be advisable, owing to the differences in the character of the timber in the various sections.

Swedish lumber is generally graded into unsorted grade, fifth, and sixth grades. Sometimes, particularly in southern Norrland and the districts around Lake Wenner, the lumber is classified into first, second, third, fourth, fifth, and sixth grades. These two systems of grading are dependent upon the mills' supply of the upper grades. Generally the small percentage of the upper grades obtainable does not make the grading into more than three grades profitable. Some mills may grade a few dimensions into six grades and the remainder into three grades.

The unsorted grade is composed of first, second, third, and fourth grades and may be termed sound construction lumber. A very small amount of discoloration is admitted in this grade and practically no rotten knots or similar serious defects. It is difficult to compare this grade with any corresponding grade for the principal species of softwoods in the United States, such as southern yellow pine and Douglas fir. It seems, however, that the maximum defects allowed in the unsorted grade would probably correspond to the medium quality of No. 2 common of southern yellow pine and Douglas fir, but the Swedish rules are stricter in regard to discoloration and allow no variation in sawing.

The fifth grade of Swedish lumber may be termed better-class cull lumber, which is used for construction purposes where strength and durability are not serious considerations. This grade is serviceable and is put to many uses for temporary construction purposes, etc. The sixth grade is cull lumber, which is not expected to have lasting qualities and is not serviceable for ordinary construction purposes. It is used locally to a great extent for lagging, boardwalks, and similar purposes where the lumber would be liable to deteriorate in a short time, and also for cheaper kinds of temporary construction.

In some mills, particularly in the northern part of Norrland, another grade of cull lumber may be established, called seventh

grade. The only requirement for lumber of this grade is that it must not fall to pieces when handled. This stock is not exported, as the freight would often amount to more than the lumber is worth.

The foregoing grading system applies to pine lumber. Spruce lumber generally is not divided into more than three grades—unsorted (comprising first, second, third, and fourth grades), fifth, and sixth grades. The same grading rules apply to spruce as to pine, but spruce lumber generally does not yield any large percentage of the upper grades on account of the presence of a large number of small knots. The knots of the spruce are not so conspicuous as those of pine and are generally not so large. Spruce often yields a disproportionately large percentage of cull lumber because older stands of spruce are liable to decay. Only a few concerns in Sweden use six grades for spruce.

There is a considerable difference between Swedish first and second grades and the corresponding grades in the United States. Clear lumber in the American sense of the word is seldom seen in Sweden and both first and second grades admit of a few knots. Some firms in Sweden at times may separate clear sap boards, which are produced in small quantities, and sell these separately to special customers abroad or to the local furniture factories.

Contrary to many grading rules in the United States, the Swedish grading rules do not allow the mixing of different species. Furthermore, the Swedish grading rules do not make provisions for miscuts or scant lumber. Whether cull stock or first grade is produced, it must have the required dimensions, no more, no less. When any scant or miscut lumber is produced, it is either resawn, or better, cut into stock for the planing mills. One will notice with surprise that many Swedish contracts for lumber exports stipulate that up to 10 per cent of blue lumber may be included in each cargo. The Swedish exporters always believe in playing safe, and although this stipulation allows the shippers to include this large percentage of discolored lumber, all the reputable shippers take great care to avoid shipping such stock because if they went to the limit in this respect it would not be long before their reputation would be seriously affected.

To many American shippers it may seem that the grading rules for the Swedish upper grades are somewhat lax, but it must be considered that the stocks are always well manufactured and carefully seasoned, and this circumstance, in connection with the efficient marketing methods, to a great extent offsets the defects, such as knots. It must be noticed that the Swedish grading rules do not make any provision for rift grain or flat grain, sapwood or heartwood. In regard to the texture of the wood there are no written regulations, but, as a general rule, very coarse-grained lumber would not be included in the upper grades.

In one respect, however, may it be said that the Swedish grading rules have changed somewhat, namely, in regard to the amount of wane permissible. Decades ago Swedish lumber was usually sawn square edged. A number of mills in Norway started to cut certain stocks with a wane, as it was realized that lumber for certain construction purposes could take a reasonable amount of wane without interfering with its usefulness. The Swedish mills adopted this system of cutting waney stock and the amount of wane has been somewhat

increased during the last decade; but in each case this matter has been taken up first with the importers. The amount of wane specified in the grading rules quoted later may seem somewhat large to shippers in the southern part of Norrland, where several mills are cutting perfectly square-edged lumber; but these mills obtain somewhat better prices for their product than the mills in the Hernosand district, to which these rules chiefly apply.

(In regard to the percentage of lumber produced of the various grades, see chapter on "Shipping regions.")

The lack of uniform grading rules for all mills is a disadvantage theoretically, but it is claimed by both the importers and the Swedish shippers that as long as there is so small a difference in the grading rules of the different mills in each district, this matter is of small importance. The importer always knows the character of the shipment of each exporter. Uniform grading rules in other countries are often so elastic that they give the exporters considerable opportunity to vary the character of their shipments, whereas in Sweden the exporters adhere closely to the rules.

Swedish exporters are especially careful to have their lumber shipped up to grade when the prices of lumber decline. Experience has taught them that importers, having bought at top price, are very particular in regard to the quality of these shipments, because it is felt by many importers that a claim may make up for the loss.

The Swedish standards of grading were not changed during the war in spite of the fact that conditions in the importing countries often prevented the importers from inspecting the cargoes with their usual care. There were, of course, some unscrupulous exporters or export merchants shipping almost any quality, but these firms are rated as war profiteers and have no standing among the reliable exporters in Sweden.

The following is a summary of the standard Swedish grading rules for sawn lumber (district of Hernosand), based on rules compiled by O. Ericson:

These rules are based on pine and spruce lumber 3 by 9 inches and 16 to 17 feet in average length, and each of the defects mentioned denotes the maximum admitted for each defect in the various grades. The defects admitted in the other dimensions are to be in proportion to the cubical contents of these dimensions compared with the above-mentioned basis, 3 by 9 inches. The number of defects admitted naturally is dependent upon the length of the pieces and will be in proportion to the above-stated average.

STANDARD DEFECTS.

Knots.—The diameter of the knots should be considered as the average diameter.

Sound knot is considered a knot firmly embodied in the wood and as solid as the wood surrounding it.

Black knot is a knot containing pitch and black in color.

Incased knot is a knot surrounded by bark or pitch.

Rotten knot is a knot not so hard as the wood surrounding it. Loose knots are considered in the same class as rotten knots.

Pin knot is a sound knot not exceeding one-half inch in diameter.

Rot or decay is any form of decay that may be evident, either as a dark-red discoloration or as white or red rotten spots.

Shakes and splits are usually a separation of the wood between the annual rings occurring during the process of seasoning (season checks), or caused by frost, wind, etc., in the forest.

Pitch pockets are openings between the grain of the wood containing pitch or bark

Wormholes.—There are two principal kinds of wormholes: Pin wormholes, generally not exceeding one-sixteenth inch in diameter, and grub wormholes, which are larger than the pin wormholes, up to about one-fourth inch diameter.

Wane is bark on the edge of lumber.

Discoloration is incipient rot of the sapwood caused by fungi, either during the process of seasoning or between the felling and the time the log reaches the mill. Such discoloration often occurs during floating.

FIRST GRADE.

Knots.—Three to four sound knots, up to three-fourths inch in diameter, and a reasonable number of pin knots are admitted, but no rotten knots are tolerated in this grade. Small, black pin knots may be allowed, provided these knots do not extend through the piece. The edges must be free from knots.

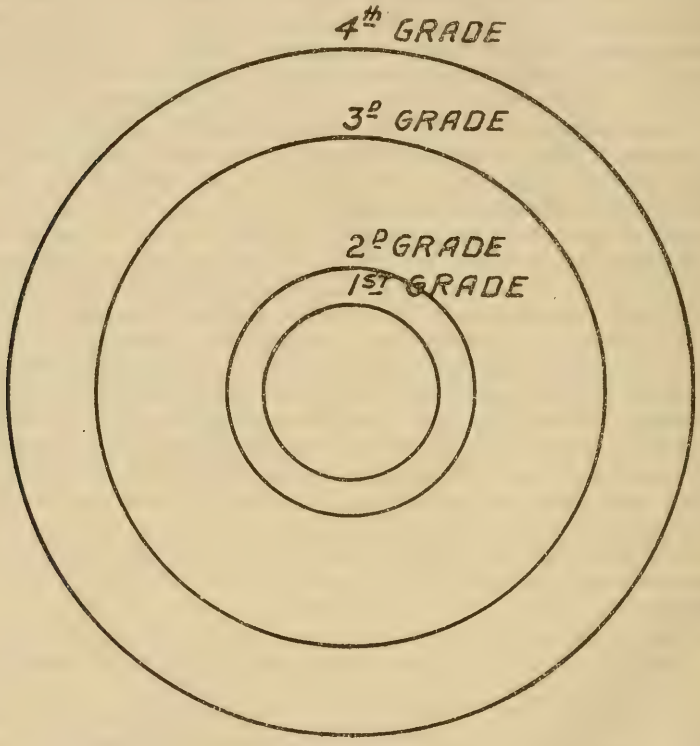


FIG. 56.—Maximum sizes of knots permitted in different grades (actual size).

Rot or decay is not admitted in any form in this grade.

Shakes and splits.—No wind-shakes are allowed in this grade. Only a limited number of very small shakes, not exceeding one-fourth inch in depth and not extending beyond two-thirds of the length of the piece, may be allowed, but these shakes must occur only on one side. No shakes are admitted on the edges.

Pitch pockets and *wormholes* are not admitted in this grade.

Wane[1] on one edge only must not extend over more than 15 per cent of the length of the piece; wane on both edges must not extend over more than 10 per cent of the length.

Discoloration.—The lumber of this grade must be strictly bright, although a few slightly discolored spots caused by crosspieces in piling may be admitted.

SECOND GRADE.

Knots.—Three or four sound knots, not exceeding 1¼ inches in diameter and another three or four sound knots, not exceeding 1 inch in diameter, may be admitted, besides

[1] The amount of wane in each grade is given in a special table at the end of this section.

a few smaller knots. Not more than 2 black knots of up to 1 inch in diameter and 2 or 3 black knots not exceeding three-fourths inch in diameter are allowed. Encased knots are allowed in somewhat smaller number and sizes than black knots. No rotten knots are allowed. Sound knots more than 1 inch in diameter must not occur on the edges.

Rot is not admitted in any form.

Shakes and splits.—No wind-shakes are allowed in this grade. Shakes occurring on one side only must not exceed one-half inch in depth. If shakes occur on both sides, they must be smaller in proportion. One small shake on the edge is admitted if running parallel with the fibers. A few small pitch pockets are admitted in this grade.

Wormholes are not allowed in this grade.

Wane.—If wane occurs on one edge only, it must not exceed 20 per cent of the length of the piece; if it occurs on both edges, it must not exceed 15 per cent of the length of the piece.

Discoloration that has been incurred during the process of seasoning is admitted in a very light form on one edge. If occurring on one side the discoloration must not exceed 1 inch in width and must not extend beyond 50 per cent of the length of the piece. Two small discolored spots caused by crosspieces are allowed.

THIRD GRADE.

Knots.—Five or six sound knots not exceeding 2¾ inches in diameter, and a reasonable amount of smaller knots are admitted. Three to four black knots not exceeding 1¼ inches in diameter may pass in this grade. Encased knots are admitted in about the same number and sizes as black knots. One slightly rotten knot may be admitted, but it must not exceed 1 inch in diameter.

Decay and rot.—Loose rot is not admitted. One solid rotten streak not extending very deeply into the piece is admitted, but the length must not exceed 4 feet and the width must not exceed one-fourth inch. A proportionally larger amount of incipient rot is admitted, provided the rot is not too prominent.

Shakes and splits.—One medium-sized wind-shake is admitted, extending up to 25 per cent of the length of the piece. Heart-shakes and similar splits are admitted not exceeding 1 inch in depth, extending up to 60 per cent of the length of the piece. If these shakes occur on both sides of the piece, such shakes must be proportionally smaller. Three shakes occurring on the edges and running in a diagonal direction through half of the width of the edge are allowed, but these shakes must be very light and must not cross one another. If the shakes extend parallel with the grain of the wood, they may be larger. A few small pitch pockets may be admitted, but they must not penetrate the piece.

Wormholes.—Three pin wormholes may be allowed in this grade and a few grub wormholes extending through 15 per cent of one edge.

Wane.—If wane occurs on one edge only, it must not exceed 30 per cent of the length of the piece; if found on both edges, it must not exceed 25 per cent of the length of the piece.

Discoloration.—Blue lumber cut from discolored logs may be admitted in this grade if the discoloration occurs on one edge and on the one face side, but the discoloration on the face side must not exceed 1 inch in width and 50 per cent of the length of the piece. If the discoloration is caused during the process of seasoning, it is admitted on one edge and 1½ inches in width on one face side, but it must not extend beyond two-thirds of the length of the piece. Five small discolored spots caused by crosspieces may be admitted.

FOURTH GRADE.

Knots.—Six or seven sound knots not exceeding 3½ inches in diameter and a reasonable amount of smaller knots may be admitted in this grade. Not more than four black knots not exceeding 2 inches in diameter may be allowed. Encased knots may be admitted in the same number and sizes as black knots. Three rotten knots not exceeding 1½ inches in diameter *or* three slightly decayed knots not exceeding 1½ inches in diameter may be allowed.

Decay and rot.—Loose rot is not permissible in this grade. One solid rotten streak on one side of the piece not exceeding 1½ inches in width and up to 20 per cent of the length of the piece is admitted. One entire edge may have incipient rot, provided that no other kinds of decay are found on the piece.

Shakes and splits.—One large wind-shake is admissible, but it must not extend beyond 60 per cent of the length of the piece and must not penetrate the plank. If beside this shake several smaller wind-shakes are found, the large shakes must be proportionally smaller. Heart-shakes and similar shakes are admitted extending up to 70 per

cent of the length of the piece and may partly penetrate the piece at one end. Four small shakes extending diagonally across the edge and five shakes extending through half of the width of the edge are allowed. Wide pitch pockets extending up to 20 per cent of the length of the piece may be admitted, if they are not of any considerable depth, but if penetrating the piece, the length must be shorter.

Wormholes.—Up to six small wormholes are admitted on one edge of the piece only, but they must not penetrate the plank. Some light grub wormholes are admitted throughout one edge.

Wane.—If wane occurs on one edge only, it must not extend beyond 40 per cent of the length of the piece; if found on both edges, it must not exceed 35 per cent of the length of the piece.

Discoloration.—Lumber cut from discolored logs is admitted in this grade and the discoloration may occur on both edges. The discoloration on the one face must not exceed 1½ inches in width and must not extend beyond two-thirds of the length of the piece. Discoloration caused by defective seasoning is admitted on one edge and up to 3 inches in width on one face side of the piece along its entire length. However, if the discoloration occurs to this extent, it must be of a very light nature. Six to eight spots caused by crosspieces are admitted.

FIFTH GRADE.

Knots.—Sound knots and encased knots are admitted in almost any number and size. Of black knots not more than six are allowed, which must be not more than 3½ inches in diameter. Slightly decayed knots must not exceed four in number and 2½ inches in diameter. Not more than four rotten knots not exceeding 1¾ inches in diameter may pass. The rotten knots must not penetrate the piece.

Decay.—Loose rot may occur in small spots. Solid rot may be admitted up to 30 per cent of the length of the piece, partly penetrating the piece. Incipient rot may be admitted in any quantity.

Shakes.—Wind-shakes may be admitted partly penetrating the piece throughout the entire length, but shakes at the ends must not be too open. Heart-shakes may be admitted penetrating the piece and extending through the entire length. Splits on the edges, running in a diagonal direction, not exceeding one-sixteenth inch in width, are admitted. If shakes run parallel with the grain, they may be somewhat larger. Pitch pockets may be large and penetrate the piece but must not exceed 50 per cent of the length of the plank.

Wormholes may be admitted in almost any reasonable quantity and number.

Wane.—If wane occurs on one edge it must not exceed 60 per cent of the length of the piece, if it occurs on both edges it must not exceed 55 per cent of the length of the piece. As a general rule, the edges touched by the saw must not be narrower than 1 inch, and the sawn face of the plank 5½ inches in minimum width.

Discoloration may occur in almost any form and quantity.

SIXTH GRADE.

Knots.—Almost any kind of knots and in any number pass in this grade, but only a limited number of rotten knots are admitted, if they penetrate the piece.

Decay and rot.—Loose rot may be admitted in the form of rotten streaks penetrating the piece, and rotten spots. Loose rot must not occur wider than 1 inch at one end of the piece. Solid rot may be admitted in unlimited quantity.

Shakes of any kind are admitted, but the plank must not fall to pieces when handled.

Wormholes are admitted in any number and size.

Wane is admitted in almost any size, but the sawn-face side of the plank must be at least 3 inches wide.

Discoloration.—Any amount of discoloration is admitted in this grade.

SEVENTH GRADE.

This grade represents an inferior grade of cull lumber and admits of almost any defects.

UNSORTED GRADE.

Unsorted grade, being composed of first, second, third, and fourth grades, may contain any defects admitted in these four grades. However, the total amount of defects allowed in the unsorted grade must be in proportion to the quantity of each of the four grades in the unsorted grade. For instance, if two rotten knots are admitted in fourth grade and if fourth grade represents 50 per cent of the unsorted grade, the unsorted grade would admit not more than one rotten knot. As the percentage of first, second,

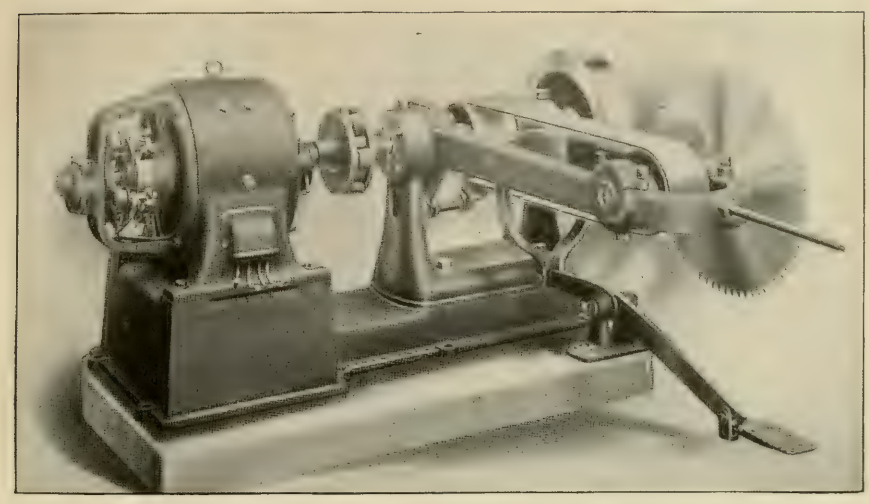


FIG. 57.—BALANCED CIRCULAR TRIMMER.

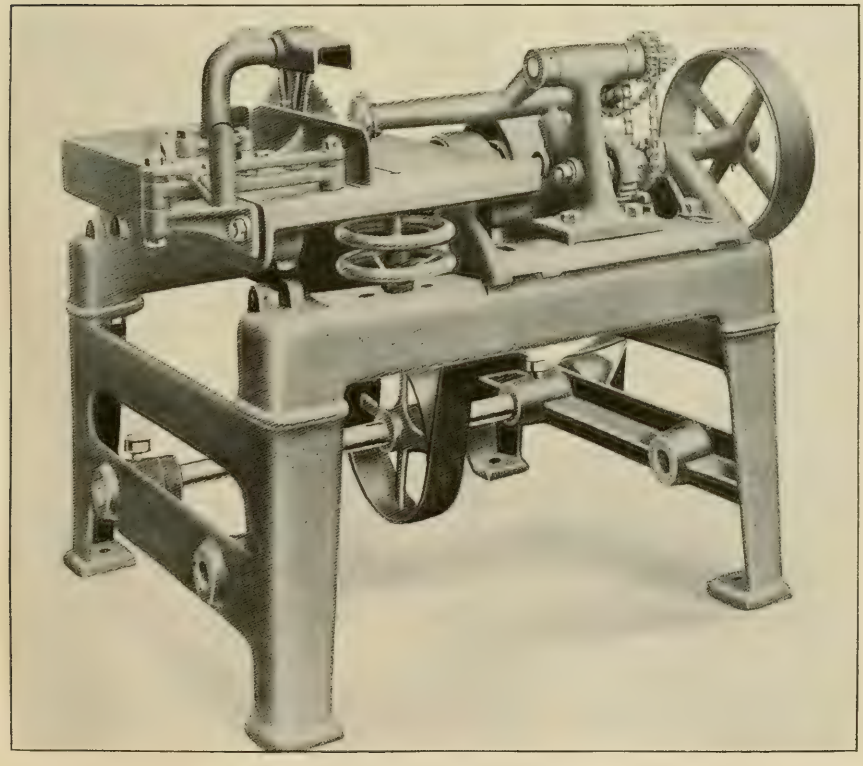


FIG. 58.—STAVE CUTTER.

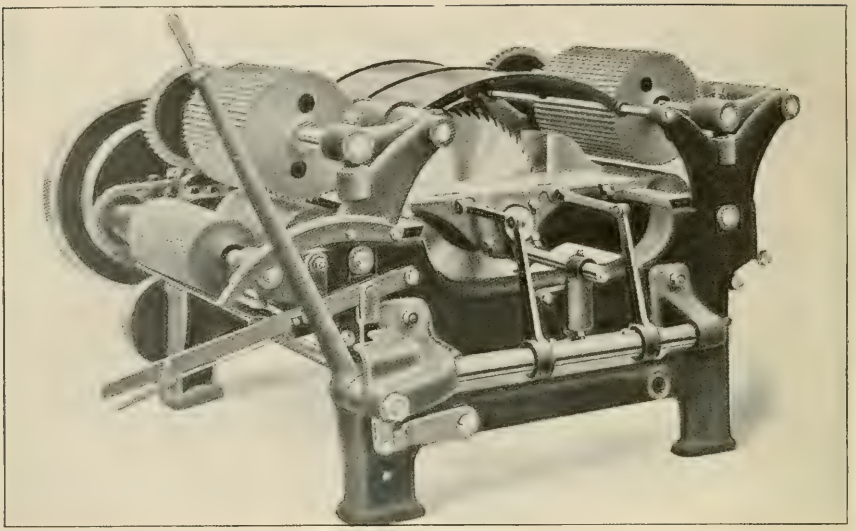


FIG. 59.—EDGER.

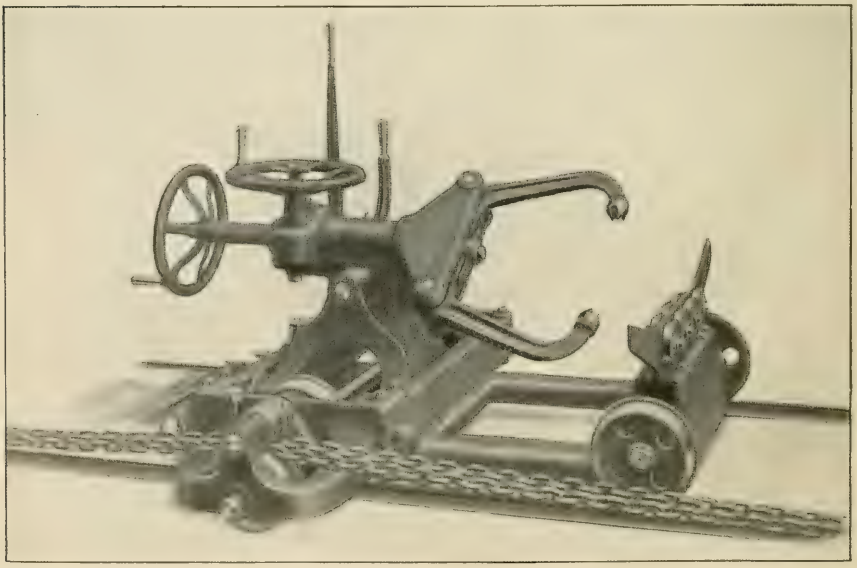


FIG. 60.—LOG CARRIAGE.

third, and fourth grades produced by the various mills may differ to some extent, it is evident that general grading rules can not be given for the unsorted grade to cover all cases without taking this question into consideration.

WANE ALLOWANCES.

The following table shows the customary amount of wane allowed for different dimensions of Swedish pine and spruce, according to figures compiled by O. Ericson. The figures represent the base of the triangle formed by the wane on two edges.

Dimensions.	First grade.	Second grade.	Third grade.	Fourth grade.	Fifth grade.	Sixth grade.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
4 by 9 inches	2 8/64	6 0/64	1 37/64	2 13/64	3 7/64	4 8/64
4 by 8 inches	2 5/64	5 6/64	1 29/64	2 5/64	2 56/64	3 50/64
4 by 7 inches	2 2/64	5 3/64	1 22/64	1 57/64	2 48/64	3 35/64
4 by 6 inches	1 59/64	4 59/64	1 14/64	1 47/64	2 39/64	3 21/64
4 by 5 inches	1 56/64	4 52/64	1 7/64	1 36/64	2 31/64	3 7/64
3 by 9 inches	2 0/64	4 59/64	1 12/64	1 42/64	2 31/64	3 7/64
3 by 8 inches	1 56/64	4 52/64	1 6/64	1 34/64	2 21/64	2 59/64
3 by 7 inches	1 51/64	4 38/64	1 2/64	1 27/64	2	2 51/64
3 by 6 inches	1 45/64	4 30/64	61/64	1 19/64	1 54/64	2 38/64
3 by 5 inches	1 38/64	4 23/64	55/64	1 12/64	1 46/64	2 26/64
2½ by 9 inches	1 48/64	3 59/64	64/64	1 24/64	1 59/64	2 38/64
2½ by 8 inches	1 46/64	3 55/64	58/64	1 19/64	1 52/64	2 31/64
2½ by 7 inches	1 43/64	3 51/64	55/64	1 13/64	1 42/64	2 18/64
2½ by 6 inches	1 39/64	3 43/64	50/64	1 6/64	1 34/64	2 3/64
2½ by 5 inches	1 33/64	3 36/64	46/64	63/64	1 28/64	1 54/64
2 by 9 inches	1 39/64	3 43/64	50/64	1 6/64	1 34/64	2 6/64
2 by 8 inches	1 36/64	3 39/64	46/64	1 2/64	1 27/64	1 60/64
2 by 7 inches	1 33/64	3 36/64	41/64	59/64	1 20/64	1 52/64
2 by 6 inches	1 30/64	3 26/64	37/64	53/64	1 14/64	1 42/64
2 by 5 inches	1 25/64	3 20/64	32/64	46/64	1 6/64	1 33/64
1½ by 9 inches	1 33/64	3 26/64	37/64	51/64	1 12/64	1 37/64
1½ by 8 inches	1 31/64	3 23/64	34/64	48/64	1 8/64	1 32/64
1½ by 7 inches	1 28/64	3 20/64	31/64	45/64	1 4/64	1 27/64
1½ by 6 inches	1 25/64	3 13/64	28/64	40/64	57/64	1 21/64
1½ by 5 inches	1 20/64	3 7/64	23/64	34/64	50/64	1 16/64
1¼ by 9 inches	1 27/64	3 13/64	28/64	40/64	57/64	1 21/64
1¼ by 8 inches	1 25/64	3 10/64	25/64	37/64	53/64	1 17/64
1¼ by 7 inches	1 22/64	3 7/64	22/64	34/64	48/64	1 12/64
1¼ by 6 inches	1 19/64	3 0/64	19/64	29/64	43/64	1 7/64
1¼ by 5 inches	1 15/64	2 54/64	16/64	25/64	37/64	1 2/64
1¼ by 9 inches	1 22/64	3 7/64	22/64	34/64	48/64	1 11/64
1¼ by 8 inches	1 19/64	3 0/64	19/64	29/64	43/64	1 7/64
1¼ by 7 inches	1 15/64	2 54/64	16/64	25/64	37/64	1 2/64
1¼ by 6 inches	1 12/64	2 47/64	13/64	20/64	32/64	56/64
1¼ by 5 inches	1 7/64	2 41/64	9/64	15/64	25/64	46/64
1 by 9 inches	1 15/64	2 54/64	16/64	25/64	38/64	1 4/64
1 by 8 inches	1 12/64	2 47/64	13/64	20/64	32/64	56/64
1 by 7 inches	1 9/64	2 41/64	9/64	15/64	25/64	46/64
1 by 6 inches	1 6/64	2 34/64	6/64	11/64	21/64	40/64
1 by 5 inches	1 1/64	2 28/64	2/64	6/64	16/64	34/64
⅞ by 9 inches	1 9/64	2 41/64	9/64	15/64	25/64	46/64
⅞ by 8 inches	1 6/64	2 34/64	6/64	11/64	21/64	40/64
⅞ by 7 inches	1 3/64	2 28/64	3/64	6/64	16/64	34/64
⅞ by 6 inches	58/64	2 21/64	59/64	2/64	12/64	28/64
⅞ by 5 inches	53/64	2 15/64	54/64	59/64	7/64	22/64
¾ by 6 inches	----	----	----	[a] 2/64	8/64	24/64
¾ by 5 inches	----	----	----	[a] 57/64	3/64	18/64
¾ by 4 inches	----	----	----	[a] 50/64	57/64	12/64
⅝ by 6 inches	----	----	----	[a] 50/64	57/64	12/64
⅝ by 5 inches	----	----	----	[a] 45/64	52/64	6/64
⅝ by 4 inches	----	----	----	[a] 39/64	46/64	1 0/64
½ by 6 inches	----	----	----	[a] 39/64	46/64	1 0/64
½ by 5 inches	----	----	----	[a] 34/64	41/64	54/64
½ by 4 inches	----	----	----	[a] 29/64	35/64	48/64

[a] Unsorted grade.

The wane allowed in the different dimensions is based on the end area of each piece. The extent of the wane allowed for the other dimensions not specified in the above tables can easily be ascertained by taking into consideration their proportionate end area. The wane for sixth quality varies a great deal and may be somewhat larger than the figure given in the foregoing table. In the smaller dimensions the wane allowed is somewhat larger in proportion to other dimensions. If the wane occurs on one edge only, the figures in the table may be increased by 25 to 30 per cent.

TRIMMING.

On the dock there are several trimming sheds, which are movable up and down the pier on a track. The trimming sheds are provided with circular saws operated by electricity. The saws have a large number of teeth in order to give the ends of the lumber a clean-cut appearance, as if it were planed. Some old-fashioned mills trim by hand, but this is very inefficient and expensive and is never practiced by the standard mills.

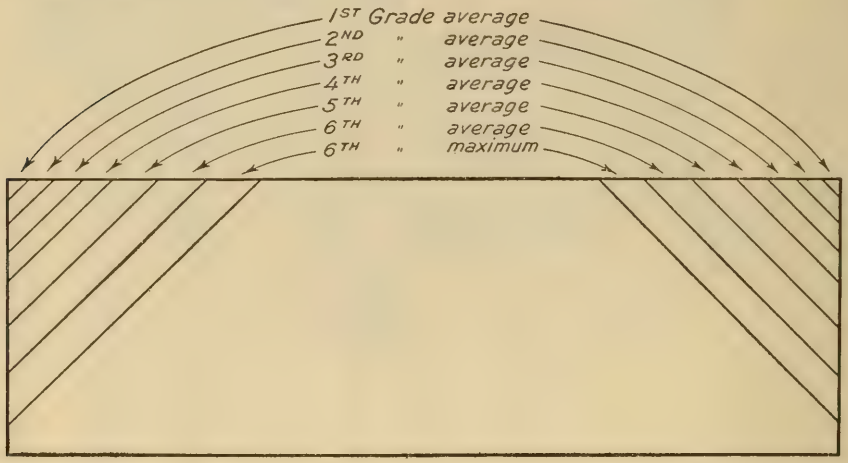


FIG. 61.—Average amount of wane permissible in various grades of a 3 by 9 inch plank (end view nearly half actual size).

The trimming sheds are attached to the end of the conveyor and the lumber is carried by the rollers to the trimming table, where it is graded and the proper lengths are marked on each piece. Sometimes customers require that the length of each piece be designated on one side in crayon. The grader carefully turns over each piece in order to determine the grade and also to raise the grade of the piece by trimming if this can be done profitably.

It must be noticed, however, that Swedish lumbermen do not sacrifice the length of a piece of lumber unless the grade of the piece can be raised at least 2 points. For instance, a plank qualified as third grade would not be crosscut into two pieces, one of second and one of third grade; but if one piece of first grade and one piece of third grade could be obtained, the piece would probably be crosscut provided both pieces would be of commercial lengths (9 feet and up).

It must also be closely observed by the grader that the average length of each plank, batten, scantling, and board must not be spoiled by crosscutting in order to raise the grade in such a way that the general average of the cargo would consist of lumber not having the average length required in each category. The grader takes enough time to do his work carefully, as it is an easy matter for the sawmill company to figure out which would pay the better, to save a few dollars per week in labor by having the lumber graded superficially or to spend a little extra money and be assured that the standard of grades would be maintained.

The butt end of the piece is first slightly touched by the saw, whereby about a half inch is trimmed off. Then the top end of the piece is trimmed to the proper length, giving each piece a slight excess of about one-fourth or one-half of an inch. The general rule is that the crayon mark must be left on the piece after it is trimmed. Swedish lumber, therefore, is never cut short. If there is any deviation from the lengths specified in the contract, it is rather a trifle too long.

Swedish lumber is trimmed to different standards of measurement, according to the country of destination. If it goes to the United Kingdom or the British colonies, it is trimmed to English feet; if it goes to France, it is trimmed to metric measurements; if it goes to Spain, it is trimmed to Spanish feet, etc. This is easy to do because it simply requires changing the measuring rod attached to the trimming table, and does not imply any extra labor.

The following schedule gives an idea of the different standard measurements cut by a company in northern Sweden: 69 per cent of the quantity shipped was cut to English feet; 7 per cent to Danish feet (1 Danish foot = 0.9711 English foot); 8 per cent to metric feet (1 metric foot = $\frac{1}{3}$ meter = 1.0936 English feet); 7 per cent to Spanish feet (1 Spanish foot = 1.0783 English feet); 4 per cent to Dutch feet (1 Dutch foot = 1.0768 English feet); 4 per cent to German feet (1 German foot = 1.0639 English feet); 1 per cent to decimeters (1 decimeter = $3\frac{15}{16}$-inches). The lumber is always trimmed to odd and even feet.

It is realized by the Swedish lumbermen that this system is wasteful, and a strong movement was started some time ago to trim all lumber either to metric measurements or to English measurements. The logs in the forest are all cut to English feet and when they are trimmed to a different standard it is evident that a loss must result. It is generally figured that 6 to 12 per cent constitute mill ends under the present conditions. The smaller the unit of the standard length measurement the smaller the percentage of mill ends.

The movement also contemplates trimming on the half foot or on the decimeter. An exporter in Sweden estimated that such a step would save the Swedish lumber exporters at least $3,000,000 to $4,000,000 a year, because it would save lumber and also increase the average length of the product, on which basis the lumber of all Swedish mills is sold.

It is expected that the members of the Finnish and Swedish Lumber Export Associations will come to an agreement whereby lumber for export in both countries shall be trimmed to English measurements only.[2]

Each shipper sells his products on an average-length basis. The lengths of lumber of different categories may vary somewhat in the various parts of Sweden. Southern Sweden ships very short lengths, for example. The Sundsvall district, in Norrland, has possibly the longest average lengths. Farther south the average lengths are somewhat less. The variations between the average lengths in the different districts in Norrland are not very considerable.

[2] This agreement has been consummated since this report was written.

The following table gives the average lengths of the different dimensions and grades of pine and spruce in Norrland:

Kinds of lumber.	Unsorted grade.		Fifth grade.	
	Pine.	Spruce.	Pine.	Spruce.
	Feet.	*Feet.*	*Feet.*	*Feet.*
Planks (11–9 inches)	16–17	16	16	14½
Battens:				
8 inches	15½	15	15	13½
7 and 6½ inches	15½	15	14½	13–14
6 inches	15	14½	14	13–14
Scantlings (5½ and 4 inches)	14–15	14–15	14	13–14
Boards:				
9 inches	16	14	13–14	13–14
8 inches	15½	14	13–14	13–14
7 and 6 inches	15	14	13–14	13–14
5½ and 5 inches	14½	13½	12–13	12–13
4½ inches	14	13–14	12–13	12–13
4 inches	12–13	11–12	11–12	11–12

In the trimming shed a large quantity of ends of boards, planks, battens, and scantlings accumulates. These mill ends are carefully retrimmed into lengths of 12 inches, 18 inches, etc., up to and including 5½ feet. In some cases even lengths of 6 inches are taken. This wood is called split wood and finds a ready market in England, Denmark, and other countries, where it is used as raw material for box shooks, kindling wood, etc. With the growth of the Swedish box-shook industry during late years, these mills utilize the mill ends themselves, and in the future mill ends, at least of the better class, probably will not be exported. Whatever is left of mill ends shorter than 6 inches or 12 inches is carefully gathered and either is used for firewood or is cut into chips for pulp material. After the shipping season is over, there is hardly a piece of waste material left on the dock.

LOADING.

Previous to the arrival of a steamer in the port, the lumber to go on that steamer is loaded into barges, usually protected on all four sides with walls and provided with a roof. These barges may hold 25,000 to 150,000 feet board measure. The lumber is tallied and inspected in the barges.

The last operation is to brand the lumber, which is done by hand using a dye made by the mills themselves of a composition similar to gelatine. The brands are put on by boys, and the expense is almost insignificant seldom exceeding two to five cents per 1,000 feet. There is one size of brand for each dimension so as to cover the entire surface of the ends, and the brands are very carefully put on, sometimes at both ends of each piece so that the brand may always be visible when the lumber is piled in the importers' yards. Split wood, staves, etc., and inferior cull lumber usually are not branded; but every other piece of lumber for export is provided with the shippers' brand. The question of branding will be discussed in detail in a later section.

The following statement gives an approximate idea of an average loading schedule. A crew of 4 men can trim, grade, and load in one day the following quantities of different dimensions: 1 by 6 inches,

23,000 feet board measure; 2½ by 7 inches, 38,000 feet; 3 by 9 inches, 55,000 feet; narrow boards, 24,000 feet.

After the barges are loaded, they are towed alongside the vessel and the lumber is taken on board. The responsibility of the shipper ceases when the lumber leaves the dock if the cargo is sold on an f. o. b. basis. But the exporters at times place their own foremen on board the vessel to insure that the lumber is properly taken care of and to see that manila rope is used whenever possible in order to prevent damage.

Loading is not effected during a rain, unless the captain should demand that this be done. In such cases, a protest is taken out by the shippers stating this fact in order to relieve themselves of responsibility in case any claim for discoloration should ensue. The same also applies if the captain has overestimated the capacity of the vessel and loads on the deck part of the cargo that should be loaded in the hold.

Spruce and discolored lumber are usually piled on deck. On account of the short shipping season in Norrland, from which about 75 per cent of Sweden's exports of lumber is exported, the shipping must necessarily be rushed, but on the other hand, long hours and almost daylight nights make it possible to load both day and night during the summer.

On an average, 200,000 to 250,000 feet board measure are taken on board per shift of 10 hours. Only in rare cases are the vessels loaded from the dock. In many districts a number of mills are located in the same ports. In such cases it is easy to arrange for shipments of parcel lots and have the barges towed a few miles to the nearest place of loading. Such parcel shipments may often be effected without any great increase in freight. By this system the exporters may easily dispose of their stocks in smaller lots, which facilitates sales. These conditions are especially noticeable in the Hernosand district.

INSPECTION IN PORT OF SHIPMENT.

Importers have found it desirable to exercise a direct control over lumber shipments from some exporting countries by having their own inspectors in the port of loading. It is understood that this has been the custom, for instance, in the Russian Baltic ports. Such plans no doubt would be opposed vigorously by the Swedish mills. At least, such inspections are not heard of in connection with planed and rough lumber exported from that country. The exporters point out the fact that if anything is wrong, they are willing to make it right and that every piece of lumber is branded and that they have also instituted a system of arbitration in foreign countries which makes it possible for the importers immediately to take up the question of claims with these representatives. This arbitration system will be discussed in another chapter.

LABOR AND WAGES.

During normal times the sawmill laborers were steady and did not shift about a great deal. The hiring and discharging of men in Sweden is generally rather complicated, and the mill owners have

realized the important bearing of a permanent crew on the uniformity of the product from year to year. Therefore the larger Swedish sawmill owners, for instance, have built homes for their men and sometimes provide land for growing the necessary articles of food. In some mills there are clubhouses, assembly rooms, bathhouses, laundries, etc., and free medicine and doctor's attendance are generally provided. If figured in money, these benefits in normal times would amount to 14 to 20 per cent of the wages paid; but it should be borne in mind that they are not offered by all the mills. Some mill owners have also established special benefit funds and look after their men when incapacitated by old age, so that the men often stay with the same mills throughout their lives. Special officers of the sawmill companies are often detailed to look after the men's welfare. Liability insurance is compulsory by law. During the war the sawmill owners facilitated the buying of food, etc., for the men and when the mills shut down for one reason or another, the owners generally made other provision for the men in regard to work.

The Swedish people enjoy exceptional educafional facilities and the percentage of illiterates is smaller there than in most other countries in the world. Furthermore, there has been a better chance for the workingman to advance himself than in most other European countries. Many prominent Swedish operators have established their present position from a very modest start.

The following statement, from a Russian authority, gives the output per laborer in an average-sized mill in Sweden and in the Archangel district of northern Russia: Minimum, 100,000 feet board measure in Sweden and 40,000 feet in Archangel; maximum, 150,000 feet in Sweden and 64,000 feet in Archangel. These figures may show, however, not only the greater efficiency of the Swedish sawmill operators but also the better equipment of the Swedish mills.

The Swedish workmen do not work exceptionally fast but they are conscientious and practical in their work. Frequently sawmill laborers in Sweden make inventions or improvements on sawmill machines and also in methods of handling lumber. In other words, the Swedish workman uses his head and is dependable.

The foremen in different mills located in the same district sometimes have local associations to discuss problems pertaining to their work, such as grading and mill operations.

Labor questions are handled through the Lumber Manufacturers Employers' Association, to which are referred all controversies between the mill operators and their men and which devotes its whole time to labor questions. In Sweden there is no rush of labor from one sawmill section of the country to another to obtain higher wages, owing to the work of this association, which establishes the scale of wages to be paid by all its members. The workmen also are organized.

INCREASED COST OF LIVING.

The pre-war wages in Sweden were not so high as those paid in the United States, but the cost of living in Sweden was very low before the war. The increase in living cost from July, 1914, to January, 1919, is shown by the following schedule, taken from official statistics, for a family spending about $536 per year before the war: July,

1914, $536; December, 1916, $746; May, 1917, $814; September, 1917, $889; January, 1918, $1,028; April, 1918, $1,088; July, 1918, $1,176; October, 1918, $1,300; January, 1919, $1,430.

The following table, compiled from official statistics, shows the cost of some of the principal articles of food in Sweden in 1913 and 1918:

Articles.	1913	1918	Articles.	1913	1918
Milk.....per quart..	$0.035	$0.096	Beef.....per pound..	$0.15	$0.69
Butter.....per pound..	.29	.72	Salt pork.....do.....	.17	.49
Eggs.....per dozen..	.26	1.17	Herring.....do.....	.041	.18
Potatoes.....per bushel..	.87	4.48	Sugar.....do.....	.08	.11
Rye flour.....per pound..	.026	.051	Coffee.....do.....	.21	.38

Most of these prices represent the maximum prices fixed by the Government; but on account of the scarcity of many articles of food there was considerable selling of food at higher than the Government prices.

WAGES.

In the sawmills and yards and on the docks all work is done on contract. This system of payment has been universally adopted throughout Sweden in all large mills and has generally given satisfaction. In the mill the basis of the contract is generally stipulated according to the number of logs sawn and in the yards and on the docks the basis is the number of pieces handled. The base price is usually regulated according to the dimensions of logs and lumber taking into consideration the working conditions of the plant, machinery, etc. The chief advantage of this system is the small cost of supervision. Furthermore, it accelerates the work, as each man's income is dependent upon the work done. If a combination of wages and contract could be worked out, however, it would be considered more satisfactory, as the contract system has its drawbacks.

In the mill the head sawyer receives a certain compensation for each hundred logs sawn, and the rest of the mill crew are paid in proportion to the amount received by the head sawyer.

The mills usually run two shifts, which were about 10 hours each, before the war, but which during the war were reduced to 57 hours per week. From January 1, 1920, the eight-hour day is compulsory by law in the industrial plants in Sweden (including the sawmills), but this does not apply to the forest and floating operations.

Besides the wages earned, most of the employees of the larger plants in Sweden have free house room and fuel for themselves and families, or at least obtain these commodities at very small charges. Although such accommodations may represent a considerable outlay of money to the sawmill, it has been necessary in most cases to provide them, as the mills often are situated far from the nearest town. The mills often cut birch in the forest to provide the workmen with fuel, because birch can not be used for pulp.

No official statistics are available in Sweden concerning the average wages for workmen in the lumber industry. The following schedule, obtained from private sources, is believed to give a correct idea of the average wages paid in 1914 and 1919 by about 75 or 80 per cent of the largest mills in Sweden. This schedule was worked out from

information obtained from various mills regarding the total amount of money earned by the head sawyers, together with the percentages of the head sawyers' wages received by the rest of the mill crew. These percentages are stated in the schedule. The value of fuel, rent, medicine, doctors' attendance, liability insurance, and other gratuities is not included in this scale.

Positions.	1914		1919	
	Per cent.	*Cts. per hour.*	*Per cent.*	*Cts. per hour.*
Head sawyer	100	14.7	100	34.8
Assistant head sawyer	83	12.2	90	31.3
Head edgerman	100	14.7	100	34.8
Assistant head edgerman	83	12.2	90	31.3
Stave sawyers	100	14.7	100	34.8
Assistant stave sawyers	70	10.3	70	24.4
Stave edgerman	65	9.6	65	22.6
Assistant stave edgerman	50	7.4	50	17.4
Stave trimmer	65	9.6	65	22.6
Assistant stave trimmer	50	7.4	50	17.4
Slab sawyer	100	14.7	100	34.8
Assistant slab sawyer	60	8.8	60	20.9
Slab trimmers	65	9.6	65	22.6
Assistant slab trimmers	50	7.4	50	17.4
Boy transporting refuse and edgings	50	7.4	50	17.4
Trimmers of lumber in mill	85	12.5	85	29.7
Assistant trimmers of lumber in mill	65	9.6	65	22.6
Graders	100	14.7	100	34.8
Assistant graders	85	12.5	85	29.7
Clean-up men	80	11.8	80	27.8
Assistant engineer	100	14.7	100	34.8
Fireman	90	13.3	90	31.3
Assistant fireman	85	12.5	85	29.7
Oiler	95	14.0	95	33.1
Log scaler	100	14.7	100	34.8
Assistant log scaler	85	12.5	85	29.7
Boom men	85	12.5	85	29.7
Men on bull chain	60	8.8	60	20.9
Common laborers	75	11.0	75	26.1
Blacksmith	100	14.7	100	34.8
Assistant blacksmith	70	10.3	70	24.4
Carpenter	100	14.7	100	34.8
Watchman	75	11.0	75	26.1
Pilers in yard	110	16.2	110	38.3
Assistant pilers in yard	(a)	(a)	(a)	(a)
Engineer (locomotive)	90	13.3	90	31.3
Switchman	95	14.0	95	33.1
Each man of crew in trimming shed	100	14.7	100	34.8
Boys branding lumber	50	7.4	50	17.4
Old men piling split wood	80	11.8	80	27.8
Boys piling refuse	65	9.6	65	22.6
Boys piling staves, etc	60	8.8	60	20.9
Boys loading and bundling staves, etc	90	13.3	90	31.3

[a] Not available.

It is seen from the foregoing table that the basis of wages for 1914 was 14.7 cents per hour for the head sawyer and that the lowest wage paid was 7.4 cents, which was earned by boys 16 to 18 years old. In 1919 the wages jumped to 34.8 cents for the head sawyers and the minimum wage to 17.4 cents. A grader usually receives a bonus at the end of the season.

The wages in the different parts of Sweden vary very little. The highest wages in 1914 were generally paid on the west coast of Sweden, where the basis was 16.1 cents and the lowest wages were paid on the east coast, where the basis was 13.7 cents.

It is generally estimated that the laborers can make 30 to 40 per cent more by working on a contract basis than if they were paid straight wages.

While the laborers in the mills work on a contract basis, the sawmill superintendent, chief engineer, yard and shipping superintend-

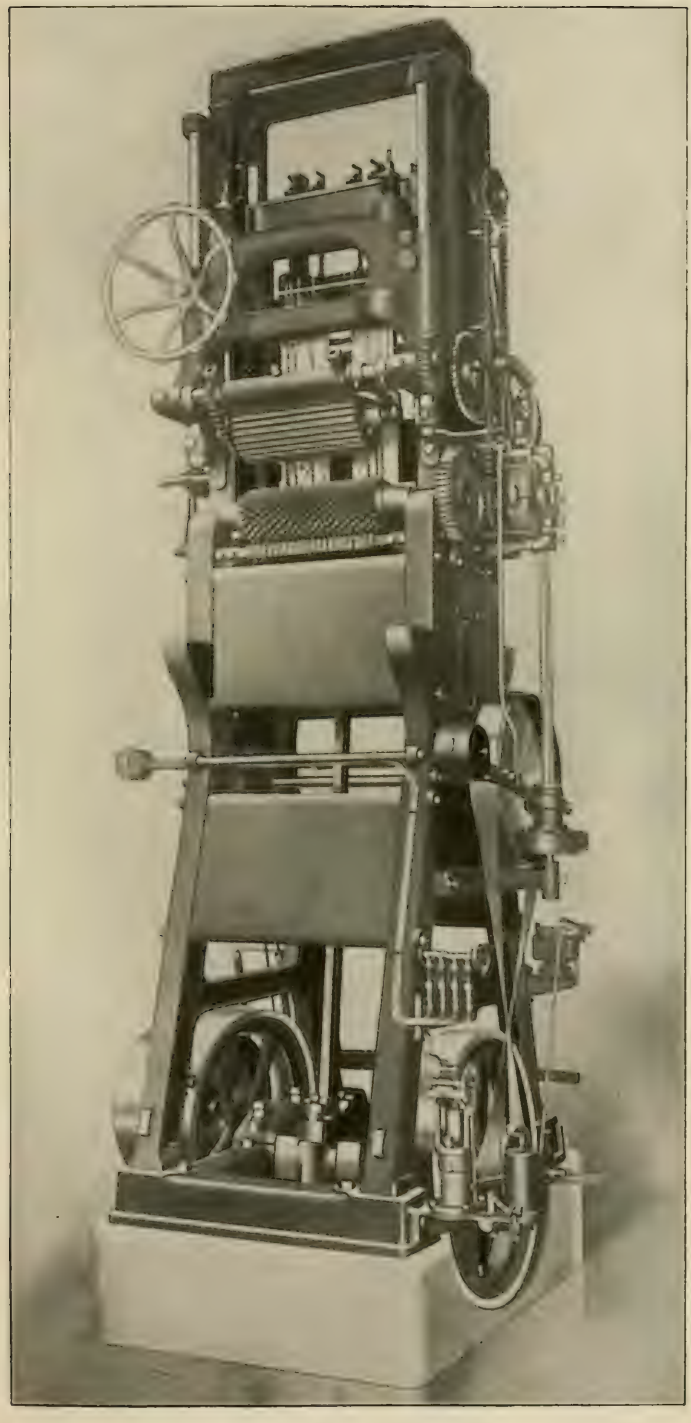


FIG. 62.—GANG-FRAME SAW.

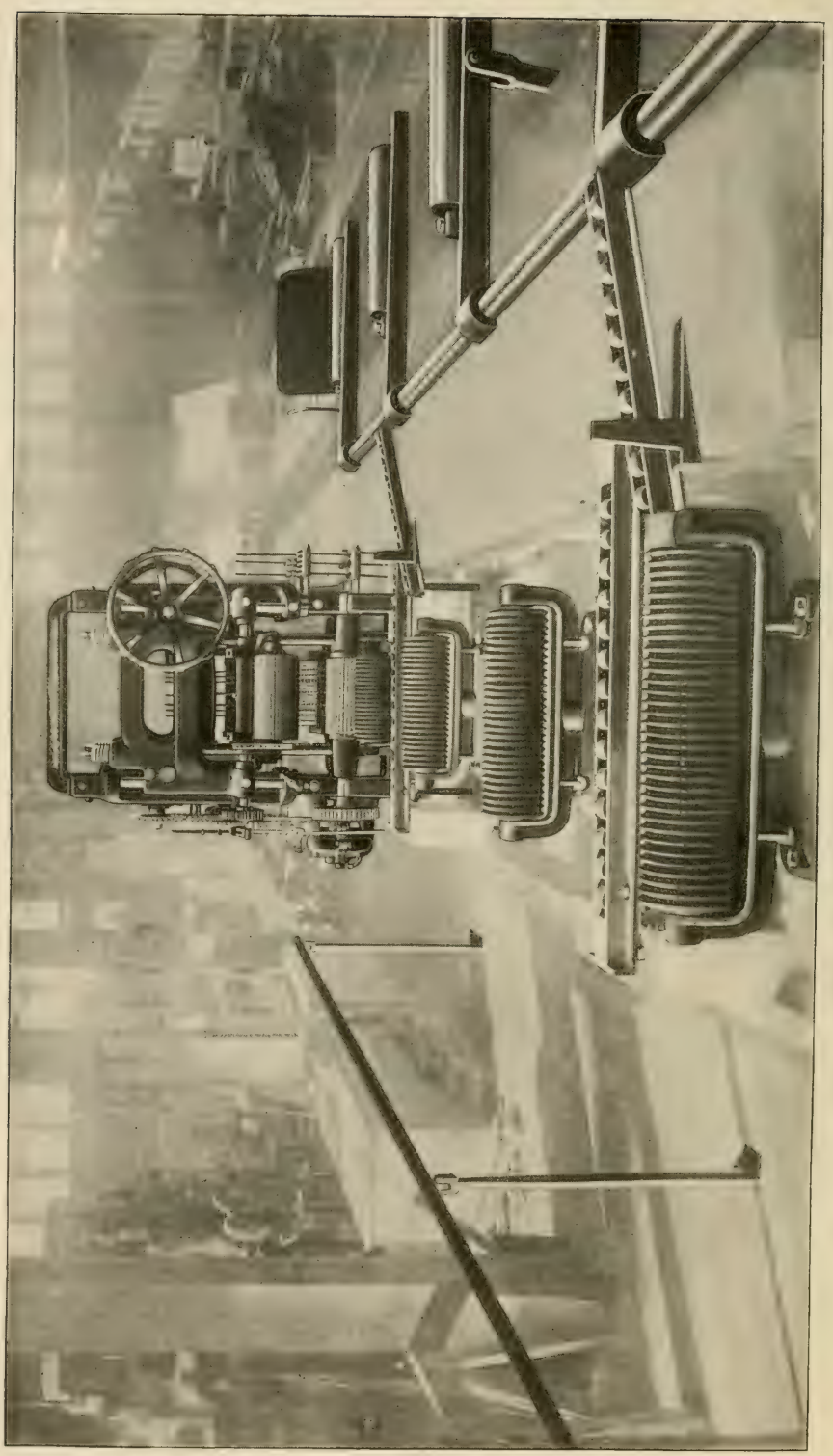


FIG. 63.—GANG-FRAME SAW FOR CROOKED LOGS.

ent, and assistant yard and shipping superintendent receive salaries, which were about as follows per year in 1914 and 1919:

Positions.	1914	1919
Sawmill superintendent	$670	$1,072
Chief engineer	670 to 840	1,072
Yard and shipping superintendent	804	1,206
Assistant yard and shipping superintendent	670	938

The following table shows a typical contract of 1916–1918 for the head sawyer's compensation for passing logs of different top diameters once and twice through the gang saw. The head sawyer and assistant head sawyer receive a bonus of 8 cents per day in addition to the compensation shown in the table. The rest of the mill crew, as has been stated, receive their pay on a percentage basis of the head sawyer's compensation.

Top diameters.	Passing log once through gang.	Passing log twice through gang.	Top diameters.	Passing log once through gang.	Passing log twice through gang.
	Cents per log.	*Cents per log.*		*Cents per log.*	*Cents per log.*
5–6½ inches	0.5	0.5	11–11½ inches		0.7
7–7½ inches	.6	.5	12–12½ inches		.8
8–8½ inches	.6	.5	13–13½ inches		.9
9 inches	.7	.6	14–14½ inches		1.1
9½–10 inches	.9	.7			

The following table shows the compensation per 100 pieces in 1916–1918 for piling lumber of different dimensions:

	Per 100 pieces.		Per 100 pieces.
4 by 11 inches	$1.07	1½ by 9 inches	$0.35
4 by 9 and 8 inches	.96	1½ by 8 and 7 inches	.32
4 by 7 inches	.68	1½ by 6 and 5½ inches	.28
4 by 6 inches	.59	1½ by 5 and 4½ inches	.25
4 by 5½ and 5 inches	.54	1½ by 4 inches	.24
3 by 11 inches	.90	1½ by 3 inches	.20
3 by 9 inches	.67	1¼ by 11 inches	.42
3 by 8 inches	.58	1¼ by 9 and 8 inches	.32
3 by 7 inches	.54	1¼ by 7 inches	.31
3 by 6½ and 6 inches	.48	1¼ by 6 and 5 inches	.26
3 by 5½ and 5 inches	.44	1¼ by 4½ and 4 inches	.23
3 by 4½ and 4 inches	.39	1¼ by 3½ and 3 inches	.20
3 by 3½ and 3 inches	.36	1 by 11 inches	.40
2½ by 11 inches	.68	1 by 9 inches	.31
2½ by 9 inches	.59	1 by 8 and 7 inches	.27
2½ by 8 inches	.54	1 by 6½ and 5 inches	.24
2½ by 7 inches	.47	1 by 4½ and 4 inches	.21
2½ by 6½ inches	.44	1 by 3½ and 3 inches	.19
2½ by 6 inches	.38	¾ by 9 inches	.27
2½ by 5½ and 5 inches	.36	¾ by 8 and 7 inches	.24
2½ by 4½ and 4 inches	.34	¾ by 6 and 5 inches	.19
2½ by 3 inches	.29	¾ by 4½ and 4 inches	.17
2 by 11 inches	.56	¾ by 3½ and 3 inches	.16
2 by 8 and 9 inches	.46	⅝ by 6 and 5 inches	.16
2 by 6 and 7 inches	.35	⅝ by 4½ and 4 inches	.15
2 by 5½ and 4½ inches	.31	⅝ by 3½ and 3 inches	.15
2 by 4 inches	.29	½ by 6 and 5 inches	.16
2 by 3½ and 3 inches	.28	½ by 4½ and 4 inches	.15
1½ by 11 inches	.44	½ by 3½ and 3 inches	.15

A special contract for sawing small timber is made on the basis of $1.14 per 1,000 pieces, representing the compensation of the head sawyer. The rest of the mill crew receive the following percentages of the head sawyer's compensation: Assistant sawyer, 90; refuse man, 60; edgerman, 100; assistant edgerman, 90; loader on cars, 100; trimmers of slabs, 75; assistant trimmers of slabs, 40; log scaler, 100.

The wages per 100 pieces for piling small timber of different dimensions were as follows in 1916–1918: 3 by 3 inches, 32 cents; 3 by 4 inches, 38 cents; 4 by 4 inches, 48 cents; 4 by 5 inches, 54 cents; 5 by 5 inches, 67 cents; 5 by 6 inches, 80 cents; 6 by 6 inches, 94 cents.

The following wages were paid for cutting, grading, and piling staves: For cutting staves one-half inch and more in thickness, 25 cents per 1,000 feet b. m.; for cutting staves thinner than one-half inch, 27 cents per 1,000 feet; for grading staves, 9 cents per 1,000 pieces; for piling staves, 19 cents per 1,000 pieces.

COST OF PRODUCTION.

No complete cost-of-production system is used by the mills in Sweden. The only efforts to standardize the cost-accounting system have been made by the employers' association, but this system relates only to the actual cost of labor. Many mills have a defective cost-of-production system and do not know what the lumber costs to produce, including all charges at the time it is ready for shipment. In comparing the cost of production in several districts in Sweden, a variation of as much as 50 per cent was found, although the principal charges for raw material and labor would be about equal at least for mills in the same district.

Some mills contend that the cost of production before the war was as low as $14.50 or $15 per 1,000 feet board measure. Upon a close examination it was found that most of these mills did not make any allowance for depreciation of the plant and similar overhead charges, because it was claimed that the plant was amortized years ago, while other mills did not set aside a certain percentage of the profits for new machinery, etc.

Stumpage values have nearly always been considered in Sweden as a safety valve for the profits, and the mills possessing their own forests do not always charge up to stumpage account the actual market value, thereby obtaining an erroneous impression of the cost of production. That there is room for improvement in this respect is evident, as the mills having efficient accounting systems feel that it would strengthen the selling policy of all the exporters if the actual cost of production were ascertained by all the mills.

In the following statement an estimate is given of the average cost of production for standard Swedish export mills for the years 1913–14, 1917–18, and 1918–19. Objection may be made to different items and the cost of production may seem somewhat high; but it is believed that this statement is generally in accordance with the actual cost of the different operations and stumpage. The calculation is not dependent upon special conditions, such as exceptionally low stumpage values based on the prices paid years ago when the stands were purchased. It is based on an average standard sawmill

of an annual capacity of about 16,000,000 feet board measure, operating 285 days in a year and requiring 118.7 cubic feet of raw material to produce 1,000 feet of planks, battens, and boards.

AVERAGE COST OF PRODUCTION OF PLANKS, BATTENS, AND BOARDS OF SWEDISH PINE AND SPRUCE IN 1913–14, 1917–18, AND 1918–19.

Items of cost.	1913–14	1917–18	1918–19
Raw material: Logs in mill pond	$11.09–$13.33	$21.24	$30.00
Pond: Storage of logs in pond, piling on land, etc.	.14– .17	.24	.30
Sawmill:			
Value of refuse used as fuel in power plant	.17– .20	1.36	1.20
Wages in mill, including transportation to yard	.95– 1.08	1.62	2.40
Repairs in mill	.14– .20	.28	.40
Supplies in mill	.27– .40	1.25	.55
Total, sawmill cost	1.53– 1.88	4.51	4.55
Yard:			
Piling in yard, wages	.51– .54	.87	1.27
Supplies	.17– .20	.51	.35
Repairs	.03– .07	.06	.10
Total, yard cost	.71– .81	1.44	1.72
Shipping:			
Wages	.68– .74	1.16	1.75
Repairs and supplies	.14– .20	.30	.40
Total, shipping cost	.82– .94	1.46	2.15
General expenses:			
Administration, office, etc.	.95– 1.02	1.27	1.50
Supervision and foremen, entire plant	.14– .20	.21	.30
Liability insurance, all departments	.06– .07	.24	.24
Taxes	.40– .47	.60	1.20
Fire insurance	.27– .30	.54	.81
Depreciation of plant	1.08– 1.22	1.08	1.08
Depreciation and interest on workmen's houses	.47– .54	.47	.47
Interest on capital for operation of plant	.61– .68	.91	1.42
Agent's commission, cash discount, etc.	1.08– 1.12	2.16	2.43
Total, general expenses	5.06– 5.62	7.48	9.45
Grand total	[a]19.35– 22.75	36.37	48.17

[a] Average, $20.30.

By analyzing the result of sawing a log it is generally found that the percentages of the different products are as follows: 70 per cent planks, battens, and boards; 8 per cent sawdust; 4 to 5 per cent loss in material through shrinkage; 12 per cent refuse and slabs (partly raw material for charcoal, pulp, and small-dimension lumber); and 6 per cent mill ends (split wood). The net value of these products at the mill is seen from the following table (basis, 118.7 cubic feet of raw material per 1,000 feet board measure):

Products.	Per cent.	Cubic feet.	Net value at mill.		
			1913–14	1917–18	1918–19
Planks, battens, and boards	70	83.3	$20.30	$36.37	$48.17
Sawdust	8	9.5	.18	1.79	1.27
Shrinkage	4	4.6			
Refuse and slabs	12	14.2	.32	.88	.58
Millends	6	7.1	.75	1.13	1.52
Total	100	118.7	21.55	40.17	51.54

The value of refuse per 1,000 feet board measure was $1.25 in 1913–14, $3.80 in 1917–18, and $3.37 in 1918–19. These figures are based on the current values in centrally located sawmill districts in Sweden. In places where there are no markets for waste material for pulp making they must be materially reduced.

Under the section "Logging" a statement has been given with regard to the cost of these operations and also an estimate of the cost of stumpage. It is believed, however, that in order to arrive at a satisfactory result in regard to the total cost of production of the lumber, it is advisable to consider the average cost of all logs delivered at the mill and not only to take into consideration the value of the logs cut in the mill's own forests, because a large percentage of the sawlogs is purchased in Sweden.

The pond charges include expenses for sorting the logs in the pond and storage on land or in water. A fair average for the whole year has been given in this estimate. The values of sawdust and refuse must be taken into consideration, as these commodities are of commercial value. The figures for sawing represent average figures covering many plants and are fairly constant, as wages are regulated by the employers' association. Charges for repairs and supplies may vary a great deal, but as these items are small, they do not influence the total cost of sawing to any great extent. The cost of transporting lumber from mill to yard is included with sawmill wages, because separate figures for transportation costs were difficult to obtain. The figures for yarding and shipping costs represent mainly wages and are fairly constant in the different plants. These figures are based on cargo shipments.

The overhead charges that figure in the books of the majority of the sawmill companies in Sweden seem to be too small and possible objections to the foregoing statement of the cost of production would probably be directed first toward these items. Attempts have been made, however, to include all reasonable charges that are believed to be consistent with a modern system of accounting in connection with sawmill operations. One important item is, for instance, the salary of the general manager, which in many cases does not figure in the accounts. Some Swedish mill owners contend that no salary should be charged, because they own the mills themselves and consequently have no actual outlay for the management. The foregoing calculation, however, has taken these and other similar charges into consideration. In an average mill before the war at least 30 to 40 cents per 1,000 feet would be required for management alone. Adequate charges are also made for office expenses, selling cost, etc.

The charges for supervision and foremen for the whole plant can not satisfactorily be distributed among the branches of the sawmill plant. The same applies to liability insurance for workmen. They have therefore been considered as overhead charges.

Taxes may vary a great deal according to the value of the plant and the location. As the system of a progressive scale in taxes is used in Sweden, this item of taxes is dependent largely upon whether or not the income of the mill is classified as excess profit. In the case of excess profit the taxes may be as high as 40 to 45 per cent as, for instance, one sawmill company in Sweden pays more than $2,000,000 in taxes at the present time.

The fire insurance covers the entire plant, including yard and houses. The charges for depreciation are considered adequate, based on a recently constructed mill. The depreciation and interest on workmen's houses must be considered because these houses, in most cases, are regarded as a necessary part of the sawmill plant.

The charges for interest on capital may seem excessive, but the same applies to this item as to the item of depreciation. Many mills fail to make adequate charges to this account. The interest is figured at a normal rate on the capital required to operate a sawmill of the mentioned capacity—that is, the capital required for wages, logs, raw material, and other expenditures.

The charges for agents' commissions, cash discount, etc., are standard charges amounting to about 5 per cent of the f. o. b. value of the lumber exported.

The total cost of production, averaging $20.30 per 1,000 feet board measure, may seem somewhat high for most sawmill operations in Sweden, and many mills, no doubt, were able to operate at a smaller cost before the war, particularly smaller mills not having excessive overhead charges. In regard to the cost of production during and after the war, it is difficult to arrive at any correct estimate. The variations for the different plants are too heavy and the values of stumpage have fluctuated materially from time to time.

As before the war, stumpage values play an important part in the cost of production. As an example of the high cost of raw material, it may be mentioned that in 1919 one mill in southwestern Sweden had a cost for raw material alone, delivered at mill, of $45.50 per 1,000 feet board measure. The wages increased materially as the cost of living went up. Lubricants, belts, and similar supplies were difficult to obtain and these commodities were often handled by persons who demanded exorbitant prices. The price of lubricants alone was a hundred times higher in 1918 than in 1913.

During the war the working hours also were decreased and this had an important bearing on the high cost of production. The increase in wages did not reach its climax at the time of the armistice, but has been climbing ever since. The institution of the eight-hour day in 1920 will materially increase the cost of production.

Stumpage values, however, seem to be on the decline; during 1919 the prices were not so high as in 1918.

The rate of interest paid on borrowed capital is higher at present than before the war. It was generally estimated that 5 to 5½ per cent was paid on borrowed capital by most of the mills before the war, whereas at present 7 to 8 per cent would probably be considered the average rate of interest.

If one considers the operation of a mill based on the production of planks, battens, and boards alone, and on purchased logs, it is easily seen that the sawmill business itself was not very profitable before the war nor even during the war, in many cases. A satisfactory profit can be made only if the waste material is carefully utilized through the combination with other industries, such as pulp mills, charcoal plants, planing mills, and box factories.

It is safe to assume that even under the most advantageous circumstances few mills in Sweden can produce lumber at present for less than $40 to $45 per 1,000 feet board measure. Immediately before the war the cost of production would run not less than $18.

If lower costs of production are given, it is believed that charges for stumpage and overhead expenses may not have been accurately calculated.

To persons not familiar with the present problems of the Swedish lumber industry it may seem that the sawmills make an unreasonably large profit on the sale of their lumber, as the prices of lumber in some cases have almost trebled, compared with the pre-war level. It appears, however, upon a close investigation of Swedish conditions that the cost of production has advanced almost in the same proportion, and were it not for the fact that the Swedish sawmills can utilize their waste material profitably many of them probably would not be in operation at present.

There is always a heavy risk in connection with the Swedish sawmill business, because the mills contracting for saw logs one year may not be able to have the lumber that is cut from these logs ready for shipment until two or even three years after the logging contracts have been made. In the meantime the prices of lumber may fluctuate a great deal and the mills may lose heavily. For instance, logs purchased at top prices during the summer of 1918 will not be ready for shipment before the summer or autumn of 1920, and as the stumpage value at that time will probably be lower than in 1918 the profits will be small.

It is believed that the majority of the Swedish mills did not make a larger profit before the war on the sale of their lumber than 6 to 8 per cent.

PLANING-MILL INDUSTRY.

The development of the lumber industry in Sweden has followed lines similar to its development in Norway. At the start, centuries ago, round logs and square timber almost exclusively were produced for export, but later this industry gradually developed into the manufacturing of sawn lumber. A further development along the lines of exporting manufactured and semimanufactured wood products, in preference to unmanufactured material, has taken place during the last quarter century, and a considerable percentage of the rough lumber is now turned into planing-mill products, box shooks, sashes, doors, etc. The relative importance of the planing-mill industry, however, is not so great in Sweden as in Norway, where most of the lumber exported consists of planing-mill products.

The most important district in Sweden manufacturing planed lumber, doors, sashes, etc., is the west-coast district, where the city of Goteborg takes the lead. The satisfactory shipping facilities for exporting, in parcel lots, to the principal European markets have developed the planing-mill industry in this part of Sweden. The box-manufacturing industry is one of the chief activities in the west-coast district. In this report sashes, doors, moldings, etc., will not be treated, as these products are in a class by themselves.

The only semimanufactured lumber products closely allied to the sawmill industry are planing-mill products and box shooks. From the statistics in a following section it will be seen that the exports of planing-mill products have increased materially in Sweden during recent years and in 1913 constituted about 15 per cent of the total quantity for export of planks, battens, and boards. During the war the manufacturing of box shooks has greatly developed.

Swedish pine and spruce are easily worked, and when planed produce a smooth and even surface in spite of the numerous knots. The small percentage of the upper grades, however, is a serious drawback. Planed Swedish pine and spruce as export articles probably would not have been known in the world's markets were it not for their excellent manufacture.

The planing mills are usually operated in connection with box factories. In southern Sweden the mills often buy rough lumber, split wood, etc., resawing this wood in the planing mills into boards; but many planing mills also operate small sawmill plants, cutting their own stock for planing purposes from logs. Part of the output of these small sawmills may be sold as rough lumber, especially the wider dimensions (9 inches and wider), because it sometimes pays better to dispose of this stock in this way than to turn it into planing-mill products. Only the better grades of boxes are manufactured from such stock.

The plan of a modern Swedish sawmill, box factory, and dry kiln is seen from figure 45. This plant is based on rail shipment, but is located close to a shipping port. The lumber cut in the sawmill is dried in a kiln, and there is a sorting table outside the mill for grading the lumber. The transportation of the lumber from the sawmill to the kiln and from the kiln to the planing mill and box factory is effected by a transfer system similar to that used in the United States.

In figure 64 is seen an efficient arrangement of the different machines in a combined planing mill and box factory. These machines are all of Swedish make.

CREW OF PLANING MILL.

The crew of a planing mill of an annual capacity of 10,000,000 feet board measure, operating two planers and two resaws, would be 28 men, as follows: One superintendent, 2 planer operators, 2 men feeding planers, 2 men at rear end of planers, 2 resawyers, 2 feeders of resaws, 2 men at rear of resaws, 2 trimmers, 2 graders, 1 filer, 3 car pushers to planing mill from yard, 2 car pushers from planing mill to shed, 3 pilers in shed, and 2 boys handling refuse.

EQUIPMENT OF PLANING MILL.[3]

The planing mills are equipped with resaws, which are circular saws of a conical shape and somewhat similar to the shingle saws in the United States; but they seldom have a larger diameter than 24 inches. The kerf is small, generally 1.5 millimeters (0.059 inch), and seldom more than $\frac{1}{16}$ inch. The feed is effected at a maximum speed of 140 to 148 lineal feet per minute. There are many types of resaws. In the larger plants double resaws are in general use. The following description outlines some of the principal features of these resaws.:

DOUBLE RESAW.

The double resaw has been designed especially for resawing planks and boards and is used by the larger planing mills and box factories.

[3] The data in regard to the machinery used in the Swedish planing mills and box factories have been furnished to a large extent by the principal manufacturer in Sweden of planing-mill machinery, J. & C. G. Bolinders Mek. Verkstad A/B., Stockholm.

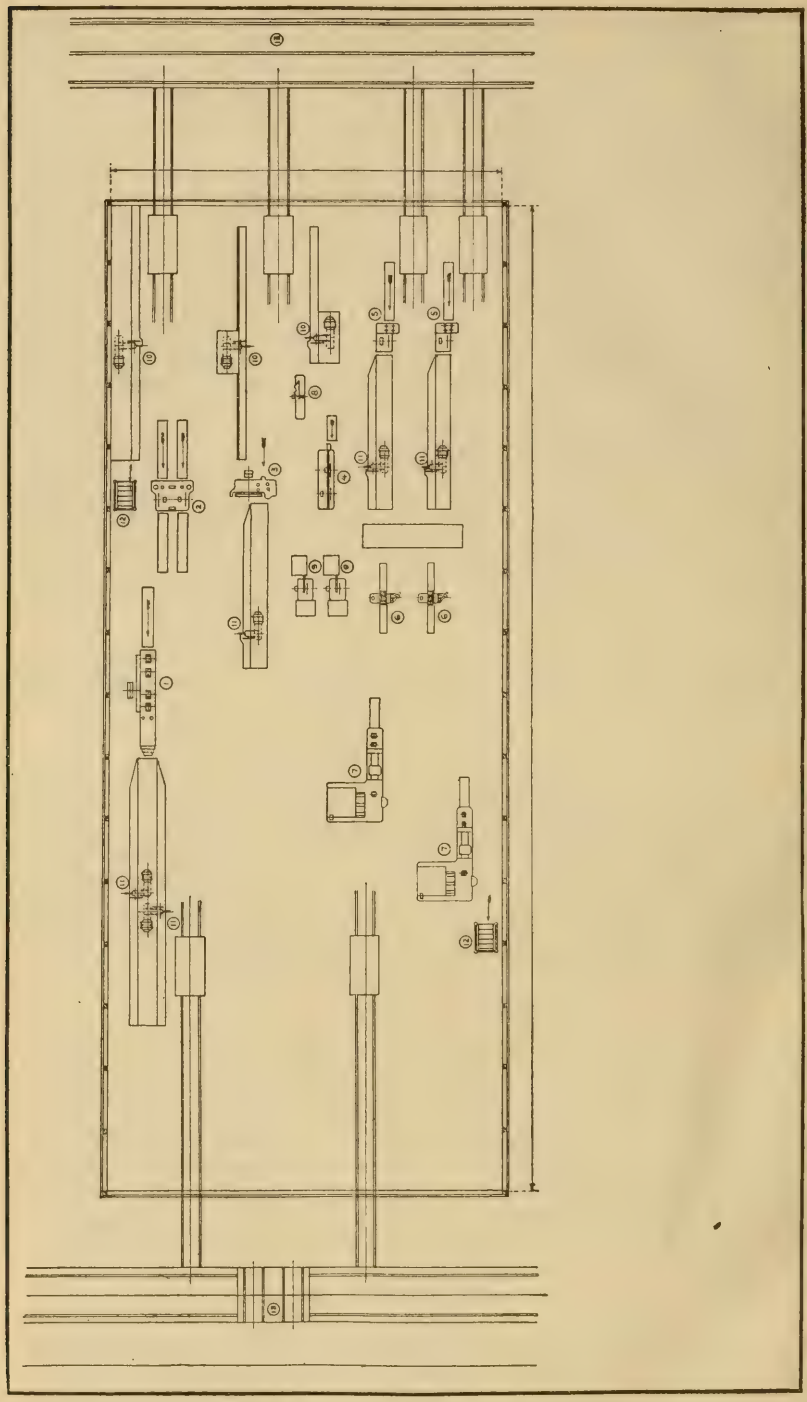


FIG. 64.—Plan of interior of Swedish planing mill. 1, planer; 2, resaw; 3, hand saw; 4, 5, resaws; 6, edger; 7, automatic box machine; 8, small planer; 9, resaw; 10, 11, trimmers; 12, stairs; 13, car transfer.

FIG. 65.—AUTOMATIC APPARATUS FOR TRANSPORTING LOGS FROM POND TO MILL.

FIG. 66.—SYSTEM OF CONVEYORS TRANSPORTING LUMBER FROM MILL TO SORTING PLANT OUTSIDE OF MILL.

FIG. 67.—INTERIOR OF MODERN SWEDISH SAWMILL.

Thin conical saw blades are used, by which lumber up to 9 inches wide can be split with a saw kerf of less than one-sixteenth inch, depending upon the condition of the wood and the dimensions. When cutting lumber of wider dimensions the saw kerf will naturally be somewhat greater.

The machine has one right-hand and one left-hand saw working together in the same frame, but each saw has its own feed mechanism and countershaft, so that they work independently of each other. Between the saws is a table with rollers both on its surface and at its edges, so that the lumber can easily be passed back over the table for resawing. The frame is cast in one piece.

Immediately in front and on both sides of the saw blades there are pressure rollers, which hold the boards steady even if the feed-roller pressure is thrown off, permitting the sawing of lumber of short lengths.

Both the feed roller and the pressure roller, independently of each other, can be set at an angle for sawing out boards that are thinner at one edge than at the other, or so-called weatherboards.

Following are the specifications for one of these machines:

Maximum depth of cut, 11¾ inches.
Maximum diameter of saw blades, 31½ inches.
Maximum distance between feed roller and fence, 7⅞ inches.
Maximum distance between saw blades and feed roller or fence, 4 inches.
Average rate of feed, 90, 110, and 132 lineal feet per minute.
Countershaft's pulley:
  Diameter, 15¾ inches.
  Face, 8¼ inches.
  Revolutions per minute, 630.

BAND SAWS AND TRIMMERS.

Band saws are used for resawing stock 9 inches and wider, because circular saws can not be used profitably for such purposes. The band saws are used principally in the planing mills and box factories. One of the largest types used in the Swedish mills is of the following description: The frame is heavy and is cast in a single piece. The feed mechanism consists of four (2 pairs) power-driven feed rollers 6 inches in diameter, journaled in heavy frames, which are movable on long slides. Following are the specifications:

Maximum depth of cut, 28 inches.
Maximum distance between feed rollers, 14 inches.
Rate of feed, 115 lineal feet per minute.
Dimensions of saw wheels:
  Diameter, 56 inches.
  Face, 5⅞ inches.
Driving pulleys:
  Diameter, 19½ inches.
  Face, 8½ inches.
Revolutions per minute, 600.
Maximum length of saw blade (without allowance for brazing), 28 inches.

The trimmers used in the planing mills are of about the same construction as those used in the sawmills, but the saw blade has more teeth.

HEAVY FAST-FEED PLANER.

Of planers there are many types. Most of them are operated on the system of rotary cutters and fixed knives combined. The follow-

ing description gives the principal features of the largest type of Swedish planer.

The feed mechanism is double and consists of four pairs of feed rollers 16 inches in diameter, of which two pairs are placed in the front of the machine and the remaining ones immediately following the bottom fixed knives, which arrangement allows an effective and powerful feed without exercising unnecessary pressure on the lumber. The upper rollers are conveniently raised or lowered by means of a crank from the front side, and an easily accessible and adjustable screw prevents them from falling too low should a board pass through without being followed up by another. The lower feed-roller spindles have their bearings in square blocks and are easily adjustable for woods of different hardness, etc. The gear wheels subject to the most wear are made of steel and all high-speed gears have machine-cut teeth. All gear wheels are well guarded by cast-iron hoods.

The cutter spindles are made of Swedish steel and revolve in ball bearings.

The front under cutter is journaled in a light but strong frame, which can be drawn out even while the machine is running. If a reserve cutter with sharp knives is always kept in readiness, the change can be made in an instant without interfering with the work of the machine. The cutter head has chip breakers on all four sides. The thickness of the chip can be regulated from the front side of the machine while it is working.

The side cutters are adjustable while running both horizontally and vertically and are furnished with cutter blocks for taking ordinary planing knives, also bushings for patent cutters, the latter being necessary if the maximum rate of feed for which this machine is designed is to be attained. Adjustable chip breakers are also fitted.

The top cutter is journaled in a very heavy frame, which is conveniently adjustable by a hand wheel from the front side of the machine. The cutter block has chip breakers on all four sides.

The last under cutter (beading cutter) is adjustable both horizontally and vertically. The bearing at one end is easily removed, whereby cutter blocks with ordinary planing knives or patent cutters can be used. By using the latter the maximum rate of feed can be maintained even when beading. The rear table can be removed, leaving the cutter free. Both the front and rear table can be moved to or from the cutter spindle, so that when adjusted correctly in position no vibration need be feared.

The bottom fixed-knife drawers are in duplicate; that is to say, they are placed side by side. Each drawer is fitted with three fixed knives placed at the most advantageous cutting angle. The drawers can be withdrawn and replaced independently of each other and without disturbing the working of the machine. A drawer with sharp knives can always be held in reserve to replace the one working in the machine when it becomes dull. There is a considerable saving of time by this arrangement, as the feed never stops while the drawers are being changed; and as the sharp knives are put in and set to work exactly before the dull ones are released, every board that passes is perfectly finished. The pressure above the drawer is regulated by means of a handle in the front side of the machine, which is connected to the drawer in such a way that when the pressure is applied the

drawer is raised and vice versa. There is a hand wheel for fixing the pressure arrangement to the size of work to be planed.

The side fixed-knife drawers are fitted on heavy slides and are adjustable while the machine is running, both horizontally for different widths of lumber and vertically, so that the planing knives can be used throughout their entire length.

The top fixed-knife drawer, which is placed immediately following the top revolving cutter, is pressed against the work by a simple device and is at the same time easy to remove.

The pressure devices are easily adjustable for different thicknesses of wood and different pressures. Over the bottom cutter and fixed knives, as also against the side cutters, the work is held in position by rollers working independently of each other, by which means uneven lumber receives an even pressure over its entire width. In front and behind the top cutter there are pressure rollers. Over the beading cutter the work is held in position by sliding pressure. The pressure rollers are furnished with closed grease cups, by which means lubrication is very effective and the lubricating material is protected from shavings, dust, etc.

The countershafts are fitted with ball bearings. The main countershaft of the planer is located behind the machine. The intermediate countershaft, with fast and loose pulley (the loose pulley running in ball bearings), as also the feed countershaft, are located under the floor; but they can also be located overhead, if necessary.

Following are the specifications for the heavy, fast-feed planer:

Maximum dimensions planed:
  Thickness, 6 inches.
  Width, 12 inches.
Rate of feed, 60, 72, 85, 98, 113, 126, 154, 181, 208, and 236 feet per minute.
Maximum capacity, 120,000 linear feet per 10 hours.
Countershaft pulley:
  Diameter, 17¾ inches.
  Face, 8¼ inches.
  Revolutions per minute, 750.

PATENT CUTTERS.

In many planing mills there is great difficulty in obtaining high-class work from knotty and cross-grained or brittle wood at a high rate of feed when using ordinary sectional cutters, as the grinding and inserting of these cutters require the greatest accuracy to insure a perfect balance, and this work consumes considerable time. This disadvantage is entirely obviated by using patent cutters.

The patent cutters are manufactured from Swedish tool steel by machines specially designed for this purpose. They are equilateral, so that every tooth cuts exactly the same amount of material. The patent cutters have six or more teeth and are circular in shape, thus insuring a perfect balance, which enables the machine to be run at a greater speed, giving a larger output. The profile remains the same until the cutter is worn out; the thickness and height of tongue can not fail to be correct. The changing of these cutters can be done in two or three minutes.

These cutters can be used on any spindle, such as four-cutter planers or spindle molders.

SHAVING CUTTERS.

The machines for chipping shavings from the planer are intended for cutting up the long shavings cut on a planing machine by the fixed knives. The machine cuts up shavings into very small pieces suitable to be carried, together with the cutter chips, in ordinary shavings spouts or in pipes, to the boilers or any other desirable place.

The machine consists of two rotary cutters, each furnished with two knives and so constructed that the knives always meet at the same place. The cutters are journaled in a common frame, which can be withdrawn for inserting, sharpening, or exchanging knives; this is done once every week. No special feed mechanism is necessary. The machine is run by a single belt.

The machine is located under the fixed-knife drawers of the planer and at a convenient distance from them. It is furnished with a fast and loose pulley and is started and stopped from the front side of the planer.

RESAWING AND PLANING METHODS.

The successful operation of a planing mill is based on a skillful utilization of raw material, as the charges for planing alone would barely cover the cost of labor. The profit derived, therefore, must be dependent upon the individual operator's success in effecting the highest possible saving in raw material. Through agreements established years ago between the exporters and consumers abroad, the price basis of planed lumber is made the rough sizes, allowing one-eighth inch on the thickness and one-fourth inch on the width of each piece for planing; for instance, 1 by 4½ inches nominal (rough) measure is required to be ⅞ by 4¼ inches actual measure (planed), and the prices based on 1 by 4½ inches. This allowance was considered necessary many years ago when the technique of the planing-mill industry was less developed than it is now. Since that time, however, the design of planing-mill machinery has made important progress, especially in the saving of material. The waste in chips when planing now amounts to only a fraction of the allowance mentioned.

Each planing mill has its own method of resawing raw material in the most profitable way, and this is usually done by resawing planks and battens into boards on special circular resaws, because the circular resaws have a smaller kerf than the gang saws. Boards are the only dimension lumber for export that is planed in Sweden.

The rough stock for planing purposes must be dried at least six months before it is planed. The moisture contents of such stock does not generally exceed 25 per cent. Many mills have found it profitable to install kilns for this purpose.

In cutting logs to produce lumber for planing purposes, special sawing schedules are in effect, which differ considerably from the sawing schedules used in cutting rough stock for export. Rough stock for planing purposes is generally cut with considerable wane. If such stock were edged in the ordinary way in the sawmill, a large percentage of raw material would be wasted in edgings; therefore, the waney stock is resawn in the planing mill and not edged before it is run through the planer, because the waney portion of the lumber is removed by the side cutters and the only consideration that must be given such rough stock is that sufficient material must be left to provide for the tongue and the groove.

The following schedule shows the system of resawing rough stock of planks and battens in many planing mills in Sweden: 4-inch stock is resawn into 3 pieces of a nominal thickness of five-eighths inch and 3 pieces of a nominal thickness of three-quarter inch; 3-inch stock, into 4 pieces five-eighths inch thick and 1 piece three-quarter inch thick; $2\frac{1}{2}$-inch stock, into 3 pieces five-eighths inch thick and 1 piece three-quarter inch thick, or 3 pieces seven-eighths inch thick, or 2 pieces 1 inch thick and 1 piece five-eighths inch thick; 2-inch stock, into 3 pieces one-half inch thick and 1 piece three-quarter inch thick, or 3 pieces three-quarter inch thick, or 3 pieces one-half inch thick and 1 piece five-eighths inch thick, or 2 pieces three-quarter inch thick and 1 piece five-eighths inch thick; and 1-inch stock, into 1 piece one-half inch thick and 1 piece five-eighths inch thick. Four pieces of weatherboard are resawn from $2\frac{1}{2}$ by 7-inch stock, which are three-quarter inch at one end and one-quarter inch at the other end. By nominal thickness is meant the thickness on which the boards are sold; the actual thickness would be less, as was previously explained.

The foregoing figures represent the resawing of regular stock sizes from the sawmill yard. Many mills, however, cut special stock for the planing mills and the following schedule gives some of the principal dimensions of this nature cut in Sweden from rough stock of planks and battens: $2\frac{15}{16}$-inch stock is resawn into 2 pieces of a nominal thickness of $1\frac{1}{2}$ inches; $2\frac{7}{8}$-inch stock, into 5 pieces five-eighths inch thick or 2 pieces $1\frac{1}{2}$ inches thick; $2\frac{7}{16}$-inch stock, into 2 pieces $1\frac{1}{4}$ inches thick or 4 pieces five-eighths inch thick; $2\frac{3}{8}$-inch stock, into 2 pieces $1\frac{1}{4}$ inches thick; $2\frac{1}{8}$-inch stock, into 3 pieces three-quarter inch thick; $1\frac{15}{16}$-inch stock, into 4 pieces one-half inch thick or 2 pieces 1 inch thick; $1\frac{7}{8}$-inch stock, into 2 pieces 1 inch thick, or 1 piece $1\frac{1}{4}$ inches thick and 1 piece three-quarter inch thick, or 4 pieces one-half inch thick; $1\frac{3}{4}$-inch stock, into 3 pieces five-eighth inch thick or 2 pieces 1 inch thick.

The first condition for employing such exceedingly fine resawing methods is that the raw material must have the required dimensions and must be accurately cut. Lumber from circular mills can not usually be resawn in the manner mentioned. Consequently the planing mills operating with stock from circular mills have greater difficulty in saving raw material unless the lumber is either cut to exact sizes or somewhat in excess of the required dimensions. Before purchasing such circular-sawn lumber, the inspector for the purchaser exercises the utmost care and takes every fraction of an inch into consideration.

Considering the fact that a large percentage of Swedish rough lumber for export is imported for planing purposes and that the importing countries frequently employ the same methods of resawing as are used in Sweden, it is readily seen to be of the greatest importance to these importers to receive Swedish rough lumber well-manufactured, especially when one takes into consideration that heavy charges for freight, custom duties, etc., are added to the cost of the raw material.

The resawing schedule given may seem unsatisfactory to many mills, because in some cases the planed lumber produced may be somewhat scant. These schedules therefore, can not be said to be in use in all mills. It depends upon the markets and the customers

of each mill to what extent they can employ such schedules. For instance, to cut 3 thicknesses of three-quarter inch each from one batten 2 inches thick, would generally be considered inadvisable. The same applies to cutting two pieces 1 inch thick from 1¾-inch stock. It is claimed that planed lumber resawn from such stock has frequently been sent to the London market on consignment. In this market the lumber is sold at auction sales and as the purchasers have an opportunity of inspecting the lumber before the purchase is made, no claims are afterwards considered, but the prices are usually correspondingly low for such scant stock. These consignment practices, however, are discouraged in Sweden.

It is generally required that the upper cutters touch the back of each board. Otherwise, the planed lumber is considered scant. If the lumber, through some faulty resawing, turns out scant, it is dressed down to the next size, in preference to having it shipped along with other stock having the required sizes. There is no provision in the Swedish grading rules to the effect that the lower grades may be shipped scant. Cull stock, as well as first grade, must always have the measurements required by the grading rules. As a rule, it may be said that the saving in raw material by resawing is larger in case of narrow widths than in wide stock.

The following example shows the resawing of a waney batten 2½ by 7 inches: 1 piece ⅞ by 7 inches; 1 piece ⅞ by 6½ or 6 inches; and 1 piece ⅞ by 5 inches. If the batten were square-edged, the width of all three pieces would have been 5 inches. In this case it is seen that considerable material has been saved by resawing the waney stock.

Besides this saving in raw material, it has also been found that the grade of discolored rough lumber, after being planed, may be raised considerably because the discoloration is often present only at the surface. This is a very important point to consider, because by planing rough discolored stock the sawmills may sell at full price a large percentage of the blue lumber, which would otherwise have to be sold at a reduction. Not only discolored lumber but also lumber containing other defects that would classify it as better class cull stock may be materially improved in grade by planing.

It has usually been found that rough lumber of other than cull and discolored stock may be raised in grade by being run through the planing mill. For instance, second-grade battens, rough stock, may yield 25 per cent of first-grade planed stock, 74 per cent of second-grade planed stock, and 1 per cent of third-grade planed stock. Third-grade rough boards may yield 100 per cent of second-grade planed stock and fourth-grade rough stock may yield 25 per cent of second-grade and 75 per cent of third-grade planed lumber. Unsorted scantlings, rough stock, may give 10 per cent of first grade, 76 per cent of second-grade, and 14 per cent of third-grade planed lumber.

The average length of the lumber also is generally increased by planing because the wane can be utilized profitably.

After resawing, the lumber is trimmed, giving the stock a small excess, usually about one half inch. From the trimmer the lumber is passed through the planer. The surface of the planed products is perfectly smooth on account of the fixed knives, which shave off thin ribbons of the same length and width as the piece. The thickness of these

shavings may be regulated; they are often thin enough to be transparent.

The planers are operated in such a way that the surface cut by the gang saw is dressed by the upper rotary cutters, while the face of the board that is being cut by the circular saw is surfaced by using the fixed knives only. This is possible because the surface cut by the circular saw is very smooth. In case of rough surface on both sides of the board, both the upper and the under cutters must be used and the fixed knives also are employed on face side, but the waste is somewhat larger by this procedure. Even the knottiest piece of lumber may be surfaced without chipping and tearing the grain, provided the stock is dry and the planing is done efficiently.

The shavings are passed through a cutter installed immediately under the planer on the ground floor of the mill. In this cutter the shavings are cut into chips for pulp material or the shavings may also be manufactured into excelsior on special machinery with revolving disks. Through blow pipes the shavings from the upper. under, and side cutters are removed.

In most cases the total waste in material through resawing and planing combined would hardly exceed five sixty-fourths inch in thickness. Thus the gain in material is made on the thickness of the board; on the width the mills do not figure on any gain.

DIMENSIONS OF PLANED LUMBER.

The usual dimensions of planed lumber are as follows: Thickness—$\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, $1\frac{1}{8}$, $1\frac{1}{4}$, and $1\frac{1}{2}$ inches, many other dimensions, such as $1\frac{3}{4}$ inches, may be termed odd sizes); width—4, $4\frac{1}{2}$, 5, $5\frac{1}{2}$, 6, $6\frac{1}{2}$, 7, 8, 9, and 11 inches; average length—15 to 16 feet for stock $6\frac{1}{2}$ inches and less in width and 14 to $14\frac{1}{2}$ feet for stock 7 inches and up.

Weatherboards and rustic also are manufactured by some concerns. Sometimes the mills may plane lumber to conform with the metric measurements, as this can very easily be effected. In trimming the lumber the same system is followed as with rough lumber. The Swedish exporters have seriously considered trying to enforce the metric system in the dimensions produced in the planing mills because a great saving in raw material could be effected through the fact that the standard of measurement in the metric system is smaller than that of the system now used. The same dimensions for planing-mill products are used in Sweden and Norway.

In some countries the importers specify that the planed boards must be of a certain specified size expressed in millimeters. In such cases the manufacturers can not make any considerable gain in raw material, but the prices are correspondingly higher. As this stock is often sold with a written guaranty in regard to measurement, some importers are very exacting in their inspection, and if a variation from the specified sizes can not be ascertained in the case of one piece of lumber, five or more pieces are piled one on top of the other and the total thickness of all five pieces measured and divided by five. If any discrepancy is found by this method a complaint is sure to follow. Some importers are provided with almost scientific instruments called micrometers, enabling them to measure dimensions of planed boards to a fraction of 1 millimeter.

Some limited quantities of moldings are produced in Sweden, but it is claimed that producing moldings for export is not profitable on account of the variety of patterns and the extra trouble in filling small orders. Therefore the mills generally do not care to cater to this trade.

GRADING AND LOADING.

The grading of planed lumber in Sweden is dependent upon so many circumstances that no one has attempted to give any definite written grading rules. The quality of the lumber itself is inferior to the usual planing mill products of soft woods in the United States, mainly because there is practically no clear lumber to be obtained from Sweden. On the other hand, the manufacturing of planed stock in Sweden is better and it is not necessary to run the planed lumber through sanders before it is used. Therefore it is possible to sell Swedish planed lumber in so distant a market as Australia, which is nearly 13,000 miles away from Sweden, but only about 7,000 miles distant from the Pacific coast of the United States.

On account of the presence of knots Swedish planed lumber is used only where it can be painted. Otherwise, the appearance is very poor.

The planed pine lumber is graded into first, second, and third grades or sometimes into four. Absolutely clear stock may be separated from the remainder of the first quality but the quantity of this grade is very small, often less than one-half of 1 per cent. The lumber may also be shipped unsorted (that is, containing first, second, and third grades in the proportion in which they come from the planer, but eliminating fourth grade and cull). Usually lumber 5 inches wide and less is sold unsorted.

Spruce lumber is usually graded into mixed grade, which consists of first and second grades, and third grade or is also sold unsorted. For the British colonies, pine and spruce are sold in two grades: Colonial first, which consists of first and second grades, and colonial third. Weatherboards are sold unsorted.

The lumber is branded according to the same system used for rough stock but it is often customary to indicate, either by a special brand or by a special color, that the stock is dressed lumber. The result of the grading of the better stocks may be given roughly as 1½ per cent of first grade, 80 per cent of second grade, 10½ per cent of third grade, and 8 per cent of discolored and cull. If graded for British colonial markets the result is usually 80 to 85 per cent of colonial first and 15 to 20 per cent of colonial third, besides cull, which varies a great deal. Cull stock may find a market in the United Kingdom and a few other countries but is usually disposed of locally.

Like sawn lumber, planed lumber is always shipped with the pine and spruce distinctly separated.

From the mill, the lumber is taken to sheds, where it is piled solidly according to dimension and grades. Thence it is transferred to barges when shipment is made. The barges are always covered on all four sides with walls and must be protected by roofs. In regard to the bundling of planed lumber, there are different regulations in almost every country.

Courtesy of Uddeholm A/B.

FIG. 68.—A WORKMAN'S HOUSE.

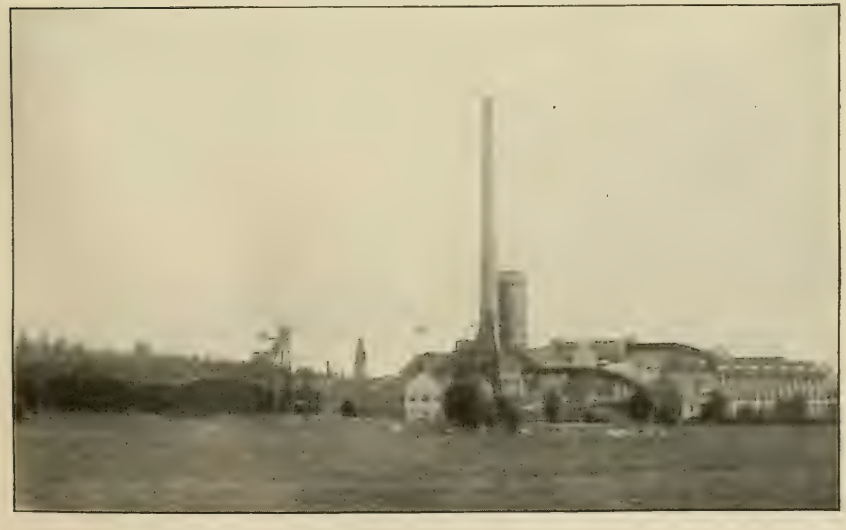
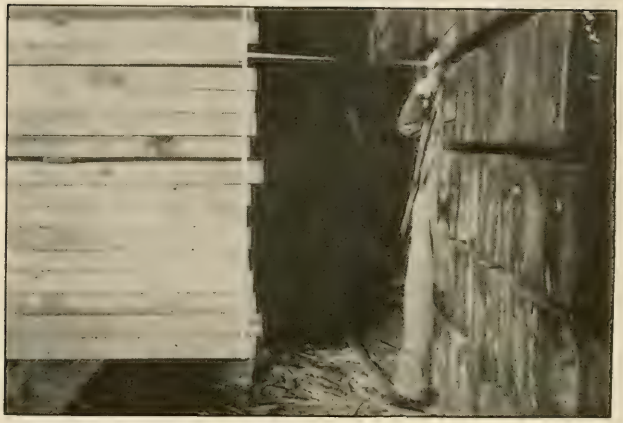


FIG. 69.—IGGESUND PULP MILL.



From Special Agents Series No. 112.

FIG. 70.—ACCURATE LENGTH MEASUREMENTS OF SWEDISH PINE. THE PLANK ALONG WHICH THE TAPELINE IS STRETCHED IS THE CORRECT MEASUREMENT.

FIG. 71.—SAWDUST PILE WORTH $10,000.

The following schedule gives an idea of the rules with regard to bundling planed lumber for shipment to some of the principal markets: London market—½ by 4–11 inches, ⅝ by 4–11 inches, and ¾ by 4–7 inches must be bundled; ¾ by 8–11 inches need not be bundled; ⅞ by 4–5 inches must be bundled; ⅞ by 5½–11 inches need not be bundled; ¾ by 4–11 inches and 1 by 4–5 inches must be bundled; 1 by 5½–11 inches and 1¼ and 1½ by 5½ inches need not be bundled. West coast of England—¾ by 7 inches need not be bundled and ¾ by 6½ inches and down must be bundled. Australia and South Africa—⅞ inch and thicker need not be bundled and ¾ inch and less must be bundled. Netherlands—¾ inch and up need not be bundled and ⅝ inch and less must be bundled. Denmark—The bundling is dependent upon the buyers' orders in each case.

The bundles are usually made up in the following way: ½-inch boards, 6 to 8 boards to the bundle; ⅝-inch boards, 5 to 6 boards to the bundle; ¾-inch boards, 4 to 6 boards to the bundle; ⅞-inch boards, 5 boards to the bundle; and 1-inch boards, 5 boards to the bundle; weatherboards, 4 boards to the bundle.

A crew of four men can load about 50,000 feet board measure of planed boards per day. If the boards are bundled, this crew can load only 30,000 feet per day.

LABOR AND WAGES.

Work in the planing mills and box factories is made on a contract basis in the same way as in the sawmills. The operators of the planer obtain a certain compensation per 1,000 linear feet of lumber turned out and the remainder of the crew receive payment in proportion to this compensation.

In 1914 the planing-mill foreman was receiving a salary of about $536 per year and in the winter and spring of 1919, $884 per year. The following percentages and wages apply to the workmen in the majority of the Swedish mills during 1914 and winter and spring of 1919:

Positions.	Per-cent-ages.	1914.	1919.	Positions.	Per-cent-ages.	1914.	1919.
		Cents per hour.	*Cents per hour.*			*Cents per hour.*	*Cents per hour.*
Operator of planer	100	14.7	34.8	Filer	90	13.3	31.3
Resawyer	100	14.7	34.8	Car pushers to planing mill from yard	105	15.4	36.5
Assistant operators of planer	70	10.3	24.4	Car pushers from planing mill to shed	100	14.7	34.8
Assistant resawyer	70	10.3	24.4	Pilers in shed	100	14.7	34.8
Trimmer	80	11.8	27.8	Boys handling refuse	50	7.4	17.4
Grader	95	14.0	33.1				

The following schedule for 1916 to 1918 is representative for contracts covering planing-mill labor in Norrland, on the basis of 2½ cents per 1,000 linear feet, with 15 per cent additional for boards 8 inches and more in width: Operator of planer, 100 per cent; resawyer, 100 per cent; assistant resawyer, 90 per cent; grader, 100 per cent; trimmer of planed lumber; 70 per cent; feeder for resaw, 65 per cent; man at rear of resaw, 60 per cent; feeder of planer, 55 per cent; trimmer (rough stock) 80 per cent. For resawing weather

boards, the wages were 5.4 cents per 1,000 linear feet; for bundling boards, 0.4 cent per bundle; for trucking boards from mill to shed, 34 cents per 1,000 feet board measure; and for trucking raw material to the planing mill, 20 cents per 1,000 feet board measure; for lumber 1⅞ inches and thicker, 27 cents; for lumber 1¾ to 1 inch thick; and 34 cents for lumber three-fourths inch and less in thickness.

COST OF PRODUCTION.

Usually many mills in southern and southwestern Sweden acquired a large percentage of their raw material by purchases of planks and battens from smaller interior mills. The following may be considered as average prices per 1,000 feet board measure f.o.b. interior sawmill, immediately before the war, for lumber of different widths: 9 inches, $19; 8 inches, $17.65; 7 inches, $17.65; 6–6½ inches, $16.85; 5–5½ inches, $15.80; 4–4½ inches, $14.75. Freight charges to the planing mill were $1.50 to $2.50 per 1,000 feet board measure.

In 1918 the corresponding prices were as follows: 9 inches, $44.75; 8 inches, $43.65; 7 inches, $42.35; 6½–6 inches, $41.30; 5½–5 inches, $40.20; 4½–4 inches, $39.10. Freight charges to the planing mill were $8.50 to $10.15 per 1,000 feet board measure.

The following statement is an estimate of the cost of planing in an average sized plant, and refers to the years 1913–14 and 1918. The present cost would probably be somewhat higher, as the wages have incerased since this estimate was made:

Items of cost.	1913–14	1918	Items of cost.	1913–14	1918
Wages	$0.95	$1.49	Depreciation on plant	$0.43	$0.95
Supplies	.41	1.22	Interest on capital	.08	.17
Repairs	.07	.14	Taxes	.14	1.08
Accident insurance and hospital	.05	.14	Total	2.18	5.29
Fire insurance	.05	.10			

BOX FACTORIES.

The essential feature in manufacturing box shooks is to effect a close utilization of raw material, and in the box factories this close utilization is accomplished to the highest possible degree. Many mills that had not previously specialized in this industry, but began manufacturing box shooks during the war on account of the large profits made during the abnormal times, now find themselves in a difficult position, because during normal times it requires more than ordinary experience in mill operation to run a box factory satisfactorily. Many people seem to think that any kind of raw material is suitable for box shooks, but this is a great mistake, and concerns operating exclusively on waste as raw material for boxes are not likely to make a success of the undertaking.

Considerable complaint is heard in Sweden of many incompetent box-factory operators failing to calculate correctly the cost of production, thereby often underselling their competitors at a great loss to all concerned.

The larger box factories use as raw material logs, planks, battens, split wood, and sawmill waste. The equipment of the mill largely

determines what raw material is used. The most profitable operation seems to be a combination of the raw materials mentioned. Even top logs down to 3½ inches are used in cutting stocks for box shooks. Of planks and battens, exceptionally waney stock not suitable for ordinary shipping stock is preferred because waney lumber can be utilized effectively, even more than in the ordinary planing mills.

Each mill has its own method of resawing the raw material. Both pine and spruce, and to some extent hardwoods, are used for this stock. Spruce is always preferred for food containers on account of the absence of smell and taste in this wood. Swedish pine and spruce are generally excellent box material and will hold nails well. The knots are firmly incased and do not come loose, and the wood does not split or check.

EQUIPMENT.

A number of small machines of various types are found in the Swedish box factories. Of resaws there are several types in use. The following description is given of a double resaw used by the larger box factories, where the splitting of short pieces of lumber into thin box boards is carried on on a large scale and where accurate dimensions and the least possible loss are necessary conditions of the manufacture. The machine is constructed with two saw blades on separate spindles, the idea being that the board sawn by the first saw is split in two by the second saw. The feed is accomplished by means of an endless chain fitted with projections, which carry the work continuously to the saw blades. The saw blades, which should be conical and have a thickness corresponding to No. 19 to 20 Birmingham wire gauge, depending upon the depth of the cut, are steadied while running by leather-covered set screws, both in front and behind the center of the blades.

Following are the specifications for this machine:

Maximum diameter of saw blades, 24½ inches.
Maximum length that can be cut with two blades, 23½ inches.
Maximum length that can be cut with two blades and special pressure device, 27½ inches.
Maximum length that can be cut with one blade, 71 inches.
Minimum length that can be cut of narrow lumber, 6 inches.
Minimum length that can be cut of wider lumber, 8–10 inches.
Maximum distance from first saw blade to fence, 2 inches.
Maximum distance from second saw blade to fence, 1 inch.
Minimum thickness that can be split, five thirty-seconds of an inch.
Maximum depth of cut, 8 inches.
Rate of feed, 39, 66, and 100 linear feet per minute.
Countershaft pulley:
  Diameter, 15¾ inches.
  Face, 8¼ inches.
Revolutions per minute, 710.

Besides a variety of planers of different sizes, built on more or less the same principle as was described in a previous section, a few types of automatic box machines are in use.

There is only one automatic shook machine of Swedish make, of which the following description is given:

This machine is intended to take material roughly trimmed and edged, and to plane, tongue, groove, glue, joint, and make up finished box sides and ends, etc., to the exact dimensions required. The operation is performed automatically from the time the boards are

fed into the machine until the finished box sides or ends, etc., are delivered by the machine.

The boards are fed into the machine as in an ordinary planer on one or both sides and are tongued and grooved. The edge is then glued if desired and the boards are jointed together, trimmed to the desired length, and cut up into widths corresponding to the dimensions of the box sides or ends, etc.

For the operation of the machine two men are required, one man for feeding the boards into the machine and one for operating the machine and looking after its planing steel, cutters, and saws.

The maximum rate of feed is 90 linear feet per minute, which for a 10-hour working day, with 6 by $\frac{1}{2}$ inch by 24½ foot lumber, makes about 9,000 feet board measure, or about 7,000 pieces of 24 by 18 inch finished box shooks. If three cross-cut saws are used, double the number of finished shooks will be obtained.

The machine consists of the following principal parts: Planing machine, glueing device, jointing device, side-shifting device, length-adjusting apparatus, cutting-up apparatus, and delivering apparatus.

The planing machine has, as usual, a feed mechanism having four driven rolls, following which come the under cutter for planing the bottom side, the top cutter for planing the top side, and the side-cutters for planing the edges of the boards and at the same time cutting the tongue and groove, which are of the dovetail type. There are four side cutters arranged, two on each side. They are all set to an angle for making dovetail joints.

The glueing device is placed immediately behind the side cutters.

The jointing device consists of a feed mechanism, which takes hold of the board as soon as it has passed the planing machine and glueing device, and by a quick motion drives it into joint with the preceding board, after which the jointed material is moved automatically sidewise by a sliding apparatus called the side-shifting device. This device moves the jointed material automatically to one side a distance equal to the width of one board, so that as each board comes from the planer, planed, tongued and grooved, and glued, it meets the preceding board in correct position for forming a joint with it.

As the jointed material is moved sidewise to leave room for each board coming through the machine, two or three crosscut saws adjust the length to an exact dimension.

By means of a resaw the jointed material is cut into box ends or sides of the exact width required.

The last device in the machine is the delivering apparatus, which delivers the finished jointed material.

The box shooks may be turned out with single or with double dovetails. In the latter case seven-eights inch stock is resawn on a band saw into two pieces three-eights inch thick, which materially increases the output.

Following are the specifications for this machine:

Maximum dimensions of finished material, 37 by 32 inches.
Minimum dimensions of finished material, 10 by 10 inches.
Maximum thickness of finished material, seven-eighths inch.
Minimum thickness of finished material, five-sixteenths inch.

Length of raw material: [4]
Maximum, 38 inches.
Minimum, 18 inches.
Width of raw material:
Maximum, 7 inches.
Minimum, 3 inches.
Rate of feed, 54, 60, 67, 73, 80, and 90 linear feet per minute.
Driving pulley:
Diameter, 11¾ inches.
Face, 7½ inches.
Revolutions per minute, 1,300.

This machine is said to work satisfactorily, but it is claimed that it has the disadvantage of requiring considerable time in changing the steel to plane shooks of different dimensions. The machine should be driven by its own electric motor of 40 effective horsepower.

SAWING OF RAW MATERIAL.

Mills sawing their shooks from logs often use the following sawing schedule, according to Forester M. Nordquist:

Top diameters of logs.	Number of shooks.	Thickness of shooks.	Top diameters of logs.	Number of shooks.	Thickness of shooks.
		Inches.			*Inches.*
4–5 inches	7	11/16	8½–9 inches	4	11/16
5½–6 inches	4	11/16		2	1
	2	1⅛		2	2
6½–7 inches	4	11/16	9½–10 inches	2	11/16
	3	1 5/16		2	1
	2	11/16		2	1 5/16
7½–8 inches	2	1		2	2
	2	1 5/16			
	1	2			

The lumber is not edged but is dried, either in kilns or in the open air. After drying the lumber is resawn on circular saws to smaller dimensions and cut to suitable lengths, whereupon each piece is edged. In this way considerable material that would otherwise be wasted in the form of edgings is saved because individual attention can be given each small piece in edging, thereby effecting the largest possible saving in raw material. If the shooks are to be dressed they are run through a planer.

One system of sawing material for box shooks has been found very satisfactory. The logs are first halved and then taken out to the yard to be dried. After drying the two half logs are cut to the required dimensions on gangsaws, with blades of 19 to 20 Birmingham wire gauge. It is claimed that lumber cut from these logs is especially firm in texture and that the knots are firmly pressed into the wood during the process of drying, so that stock cut from these logs is especially suitable for planing purposes. It is claimed that the waste of each log that can not be turned into box shooks represents only 17 to 18 per cent of the cubical contents of the logs.

Another system of manufacturing box shooks is used by the Säfveåns A/B. of Goteborg, which has improved upon a machine that is manufactured and commonly used in the United States. This mill cuts the lumber from logs with a large percentage of wane. The wanes are

[4] The raw material should be at least ⅛ to ¼ of an inch longer than the finished material.

then edged at an angle of 20, 30, or 40 degrees, according to their form, whereby only a slight portion of each plank or batten is edged. By sorting the various categories of raw materials representing 20, 30, or 40 degree wanes and running this lumber through the American box machine, the pieces are glued together in the way shown in figure 95. Furthermore, the mill also takes advantage of the taper of the log by joining the butt and the top end together as seen on the same figure. This represents the closest utilization of raw material found in any factory in Sweden. The glued and joined pieces are thereupon resawn on band saws into suitable thicknesses.

Besides the considerable saving in raw material this system has another advantage of having a larger gluing surface at the joints, which materially strengthens the shooks.

DIMENSIONS OF SHOOKS.

There are very few standard dimensions of box shooks. Even some of the largest importers abroad do not seem to understand the advantage of standardizing their shook specifications. The mills in Sweden are therefore generally unable to keep shooks in stock but make them on special orders.

The prices vary materially in each case, depending upon specifications. It is always a matter of bargaining whether the boxes shall be made up of one, two, three, or more pieces, and this materially influences the price, as the supply of wide stock in Sweden is limited and its prices are high.

The following are a few standard box specifications turned out by the Swedish factories:

		Dimensions.
Pyramid butter box for Ireland: [5]		
	2 ends	12 inches base, 11 inches top, 13 inches high, $\frac{9}{16}$ inch thick.
	2 sides	13$\frac{1}{8}$ inches base, 12$\frac{1}{8}$ inches top, 13 inches high, $\frac{9}{16}$ inch thick.
	1 top	12$\frac{1}{8}$ by 12$\frac{1}{8}$ by $\frac{9}{16}$ inch.
	1 bottom	13$\frac{1}{8}$ by 13$\frac{1}{8}$ by $\frac{9}{16}$ inch.
Soap boxes for United Kingdom:		
I	2 ends	13$\frac{3}{8}$ by 8$\frac{3}{4}$ by $\frac{3}{8}$ inch.
I	2 sides	18$\frac{3}{4}$ by 8$\frac{3}{4}$ by $\frac{3}{8}$ inch.
I	1 top	18$\frac{3}{8}$ by 13$\frac{1}{8}$ by $\frac{5}{16}$ inch.
I	1 bottom	18$\frac{3}{8}$ by 13$\frac{3}{4}$ by $\frac{5}{16}$ inch.
II	2 ends	15$\frac{1}{2}$ by 6$\frac{7}{8}$ by $\frac{3}{8}$ inch (planed on one side).
II	2 sides	20$\frac{1}{8}$ by 6$\frac{7}{8}$ by $\frac{5}{16}$ inch (planed on one side).
II	1 top	20 by 15$\frac{1}{2}$ by $\frac{5}{16}$ inch (rough).
II	1 bottom	20 by 15$\frac{7}{8}$ by $\frac{5}{16}$ inch (rough).
Salt boxes for United Kingdom:		
	2 sides	14$\frac{5}{8}$ by 13$\frac{1}{4}$ by $\frac{5}{16}$ inch (made up from 3 and 4 inch shooks.)
	2 ends	13$\frac{1}{4}$ by 13$\frac{1}{4}$ by $\frac{5}{16}$ inch (made up from 3 and 4 inch shooks).
	1 top and 1 bottom	13$\frac{7}{8}$ by 13$\frac{7}{8}$ by $\frac{5}{16}$ inch (made from up 3 and 4 inch shooks).
	4 braces	13$\frac{1}{4}$ by 2 by $\frac{3}{8}$ inch.

One factory in Sweden has standardized the manufacture of boxes called "Torroba," which are sold mainly in the United Kingdom. The box shooks are made on the American box machine previously referred to, and it is claimed that these boxes require 20 per cent less wood than boxes of the same capacity turned out

[5] Shooks to be planed on both sides and edges; measurements refer to planed stock.

by other factories. This is due to the special features of tne manufacture that have already been explained.

A strength test made by the Chalmerska Institute in Goteborg shows the amount of pressure possible on Torroba boxes and boxes of ordinary construction. Ordinary nailed box of usual type, con-

TORROBA SYSTEM OF SHOOK MANUFACTURE

FIG. 72.

sisting of several shooks (three-fourths-inch ends, five-eighths-inch sides, bottom and top), 909 pounds; nailed Torroba box (five-eighths-inch ends, one-half-inch sides, top and bottom), 1,320 pounds; lock-cornered Torroba (five-eighths-inch ends, one-half-inch sides, top and bottom), 1,833 pounds.

SHIPMENTS.

Box shooks are shipped mainly on regular liners in parcel lots. The box shooks are tied with wire or other binding material and often stamped with the importer's brand. The branding machines are nearly all of American make.

COST OF PRODUCTION AND LABOR.

It is impossible to give any general statement in regard to the cost of production of box shooks, as many special features enter into consideration in each case. The following schedule may serve as a guidance in regard to the cost of labor covering a district in Norrland during 1916 to 1918:

	Cents per 1,000 linear feet.
Sawyer:	
3¼ inches and less in width	7
3½ to 5¼ inches	9
5½ to 6¼ inches	10
6½ to 7¼ inches	12
7½ to 8¼ inches	15
8½ to 9 inches	16
Edgerman:	
5/16 inch and less in width	2
3/8 to 5/8 inch	4
Thicker stock	5
Trimmer:	
5/16 inch and less in width	3
3/8 to 5/8 inch	4
Thicker stock	5

READY-CUT HOUSES—SASH AND DOOR FACTORIES.

A few attempts have been made to start manufacturing ready-cut houses for export. For various reasons these undertakings have not been successful, and factories specializing in this product on a large scale are not found in Sweden. It is probable, however, that such an industry will be started in the future if a demand should be created abroad for these houses, but high prices for raw material and labor in Sweden prevented the starting of this industry during the war.

The sash and door industry is entirely separated from the sawmill business and is located chiefly in the Goteborg district on the west coast of Sweden. Important factories are found, but they are not operated on so large a scale as similar factories in the United States. The machinery in many cases is imported chiefly from the United States. The industrial statistics of Sweden give the total value of the product of the sash and door factories combined as about $2,200,000 in 1915. Sash and door factories are sometimes operated in connection with planing mills, but as a rule they form a separate industry and will not be considered in this report. A normal year's exports of sash and doors from Sweden are about $900,000.

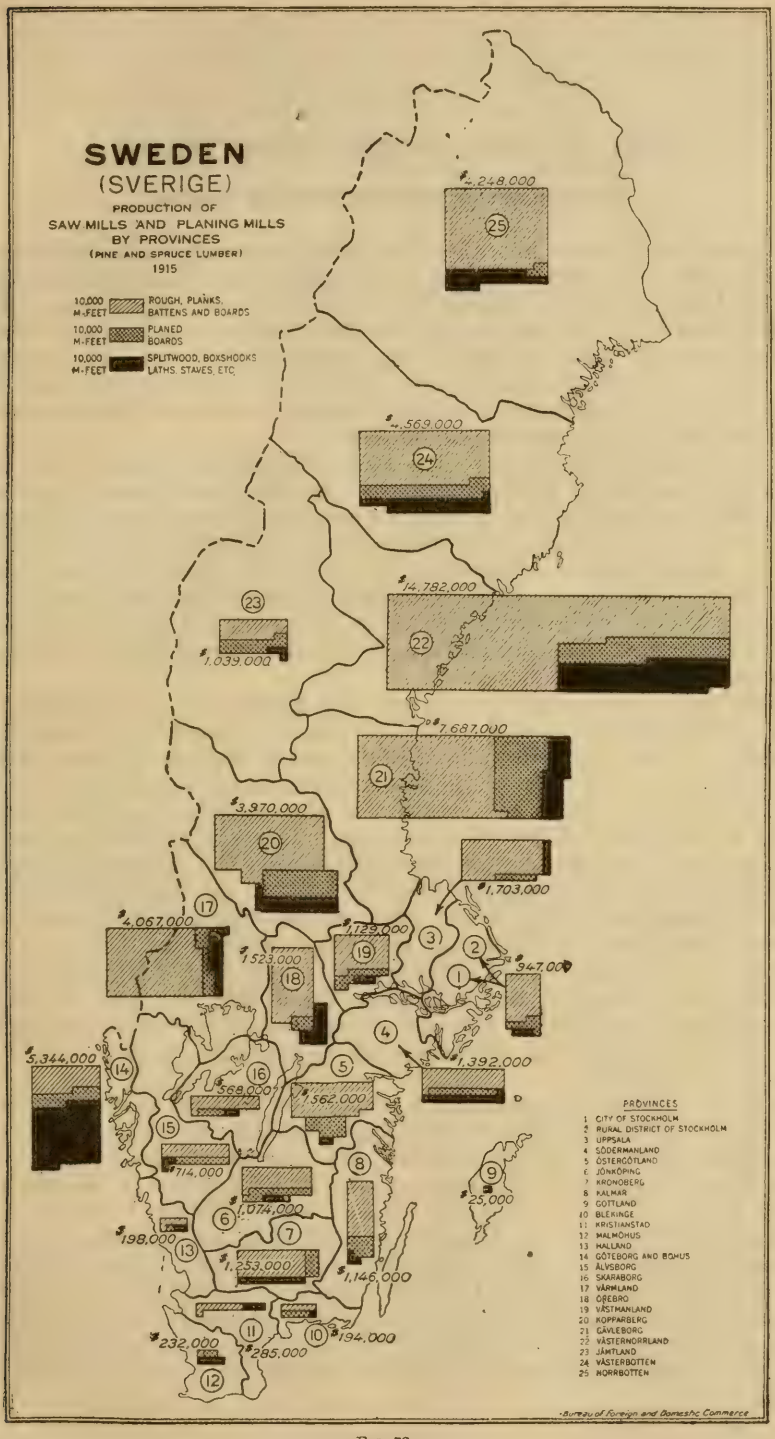

SWEDEN
(SVERIGE)
PRODUCTION OF
SAW MILLS AND PLANING MILLS
BY PROVINCES
(PINE AND SPRUCE LUMBER)
1915
10,000 M-FEET ROUGH, PLANKS, BATTENS AND BOARDS
10,000 M-FEET PLANED BOARDS
10,000 M-FEET SPLITWOOD, BOXSHOOKS LATHS, STAVES, ETC.
$4,248,000
$569,000
$14,782,000
$1,039,000
$7,687,000
$3,970,000
$1,703,000
$4,067,000
$1,129,000
$1,523,000
$947,000
$5,344,000
$1,392,000
$568,000
$1,562,000
$714,000
$1,074,000
$198,000
$1,253,000
$1,146,000
$232,000
$285,000
$194,000
$25,000
PROVINCES
1 CITY OF STOCKHOLM
2 RURAL DISTRICT OF STOCKHOLM
3 UPPSALA
4 SÖDERMANLAND
5 ÖSTERGÖTLAND
6 JÖNKÖPING
7 KRONOBERG
8 KALMAR
9 GOTTLAND
10 BLEKINGE
11 KRISTIANSTAD
12 MALMÖHUS
13 HALLAND
14 GÖTEBORG AND BOHUS
15 ÄLVSBORG
16 SKARABORG
17 VÄRMLAND
18 ÖREBRO
19 VÄSTMANLAND
20 KOPPARBERG
21 GÄVLEBORG
22 VÄSTERNORRLAND
23 JÄMTLAND
24 VÄSTERBOTTEN
25 NORRBOTTEN
Bureau of Foreign and Domestic Commerce

FIG. 73.

PART III.—THE LUMBER EXPORT TRADE.

DEVELOPMENT OF THE EXPORT TRADE.

Timber and lumber have been exported from Sweden for centuries. At the start this trade was to a large extent in the hands of the Hanseatic League but it passed later to the Dutch merchants. The Netherlands was the largest market for Swedish wood in the seventeenth century and imported large quantities of timber for shipbuilding and other construction purposes. Lumber was not exported in large quantities because Swedish logs were manufactured into lumber in the importing countries.

In the eighteenth century, the United Kingdom became the principal market but at the beginning of the nineteenth century several difficulties were placed in the way of imports of lumber into this market, with the exception of lumber from the North American Continent. Heavy duties amounting to even $26 per 1,000 feet were imposed on lumber at one time. Restrictions in Sweden also limited the exports of wood products, such as export duties and shipping restrictions, etc., many of which were in force even up to the middle of the last century.

The duties on lumber imported into England were abolished in 1866, and from this time the Swedish lumber export trade grew very rapidly. Prior to the middle of the century trade had been carried on mainly by the west coast and the east coast of Sweden as far north as Gevle. With the creation of the important sawmill industries in Norrland about 60 years ago, the export trade gradually changed over to this part of the country, and the Norrland shipping districts have now been exporting the bulk of the lumber from Sweden for decades. The total value of the lumber and timber exported from Sweden during the last 50 years prior to the war, from 1864 to 1913, was $1,456,738,000, of which $1,122,383,000 represented the values of the shipments from the Norrland districts. The value of the lumber shipped from the whole of Sweden during this period represented about 34 per cent of the value of all commodities exported.

The last 50 years represents a steady increase in the lumber exports up to 1897. From this time on the quantities exported varied to some extent and reached their lowest ebb in 1909. After this time the export trade increased up to 1913, when it reached the 1897 level. The war naturally caused much change in the export business and in 1914 the quantities declined to some extent, but the following two years, 1915 and 1916, represent very good shipping seasons, 1916 being a record year in the history of the Swedish lumber trade. In 1917 and 1918, difficulties were experienced and the quantities exported were very small, but the profits realized on these small quantities were greater than were generally obtained before the war.

In considering the Swedish export statistics, it must be kept in mind that the success of the export trade should not be judged exclusively by the quantities shipped. The Swedish lumber exporters do not flood foreign markets with their lumber during dull times.

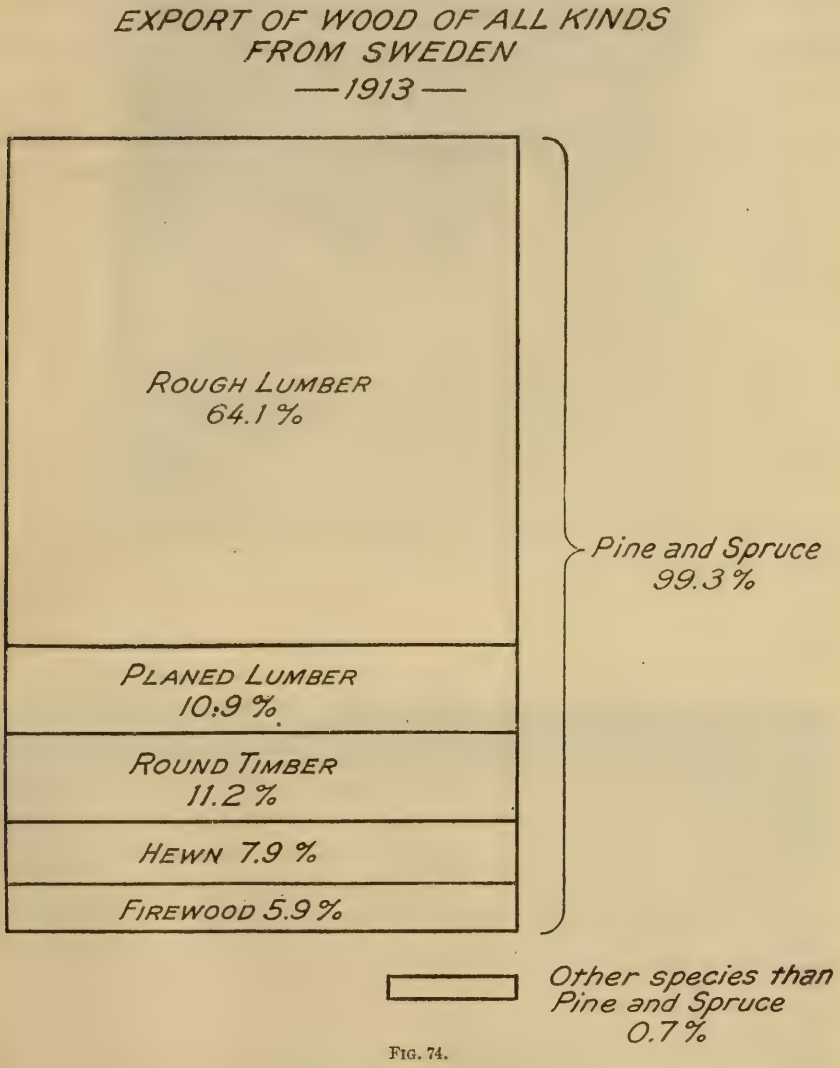


FIG. 74.

When prices are unsatisfactory, the exporters prefer to curtail their output for export and favor the policy of exporting smaller quantities of lumber at fairly satisfactory prices, rather than trying to impose upon the markets large quantities of lumber in excess of the demand. Since the crisis after the Franco-Prussian War, when the prices of lumber dropped in a short time more than 50 per cent, thereby eliminating a large number of mills from the exporting business, there has been no serious crisis which the Swedish lumber exporters have not been able to overcome.

The mill owners frequently contend to the foreign importers that it pays them better to leave their trees standing than to cut them during dull times and realize only small profits or none at all. The growing trees always yield a profit in the form of annual increment, and although this annual increment represents a smaller percentage on the investment than would be derived from the sale of lumber

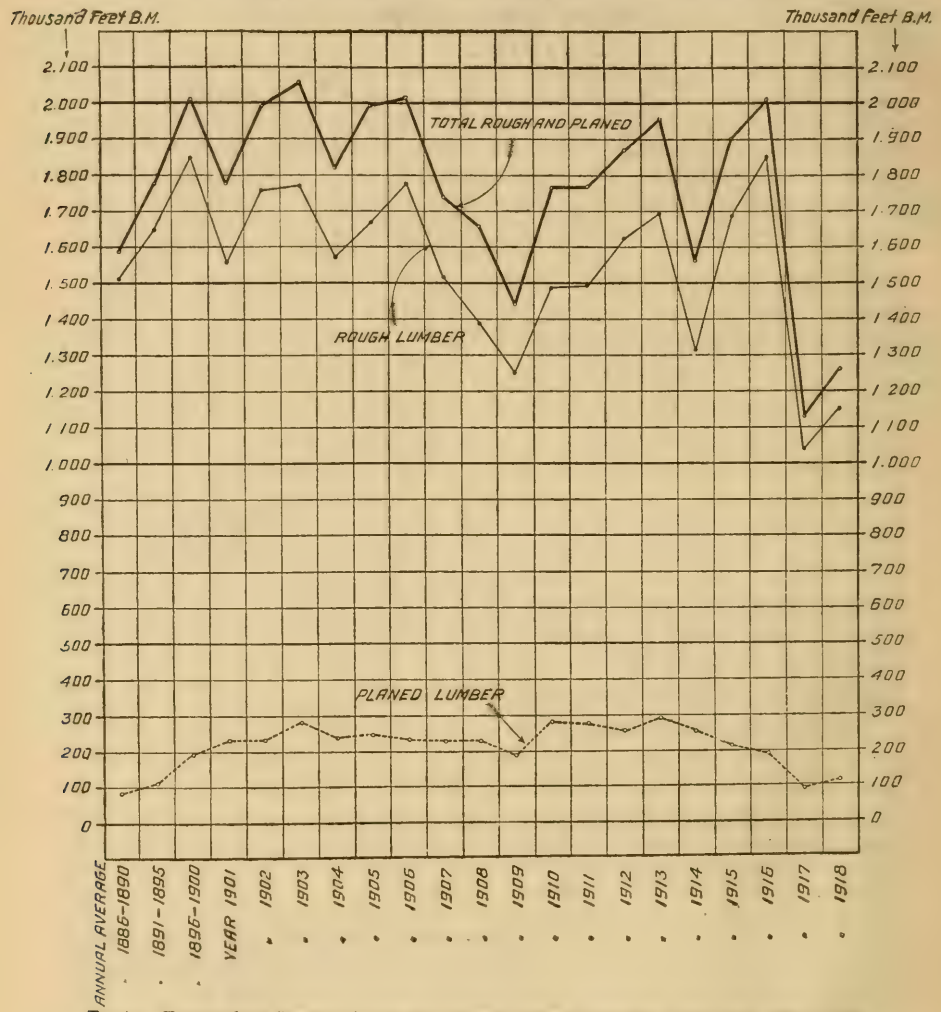


FIG. 75.—Exports from Sweden of rough and planed lumber of pine and spruce, from 1886 to 1918.

during ordinary times, it is considered better to take this smaller profit than to endanger the prices of the total output by dumping excess quantities on the market.

SAWN AND PLANED LUMBER.

Although Swedish exports of timber and lumber have not grown in proportion to those of Finland, it must be noticed that the quantities of sawn and planed lumber are larger than the corresponding

FIG. 76.—HORSE EATING CELLULOSE FOOD.

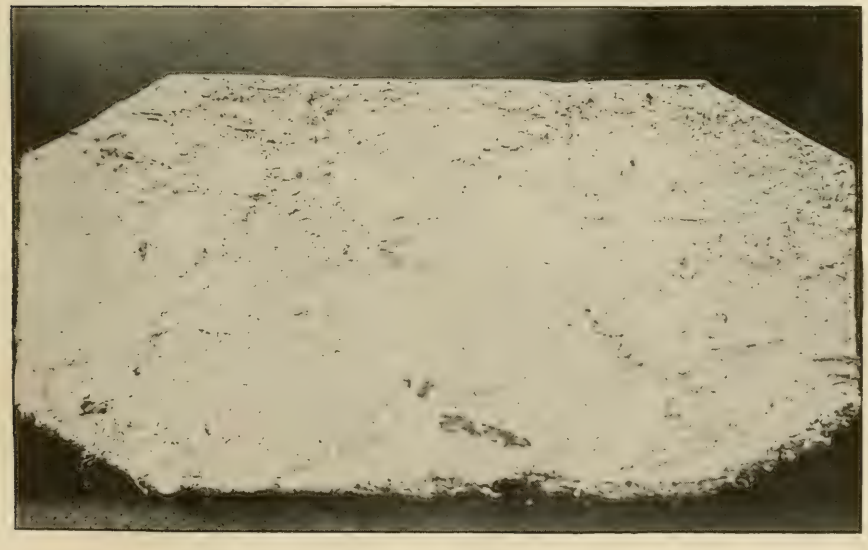


FIG. 77.—BRIQUET OF COMPRESSED SAWDUST.

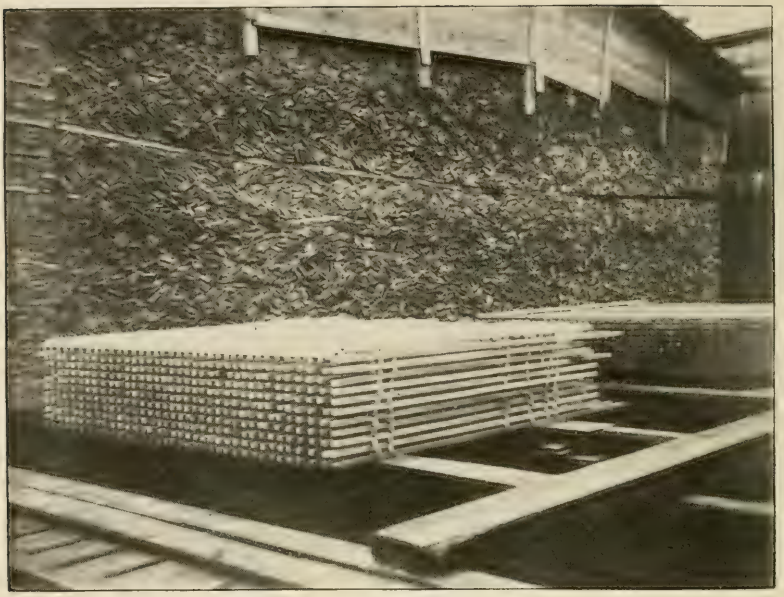


FIG. 78.—BROOM HANDLES.

FIG. 79.—PILES OF LUMBER COVERED WITH TARPAULINS.

figures in Finland. The exports of round logs, small timber, etc., represent important items in the Finnish wood-export trade. Sweden does not compare so favorably in this respect with Norway, where the percentage of planed-lumber products is especially high. In fact, the tendency to increase the proportion of manufactured lumber exported started in Norway and gradually moved eastward.

The following table gives the percentages of pine and spruce lumber of different widths and thicknesses exported from Sweden from 1913 to 1918:

Kinds of lumber.	1913	1914	1915	1916	1917	1918	Average, 1913–1918.
Rough stock:							
Planks and boards 8½ inches and up	*Per cent.* 20.23	*Per cent.* 17.28	*Per cent.* 19.88	*Per cent.* 21.01	*Per cent.* 17.60	*Per cent.* 17.30	*Per cent.* 18.89
2 inches thick and up—							
Pine	12.58	10.76	12.62	13.33	9.79	9.51	11.43
Spruce	4.34	3.92	4.86	5.09	5.01	4.30	4.59
Less than 2 inches thick—							
Pine	2.49	2.05	1.78	1.87	1.86	2.60	2.11
Spruce	.82	.55	.62	.72	.94	.89	.76
Battens and boards, 6 to 8½ inches wide	32.87	34.91	36.01	37.39	39.06	39.06	36.55
2 inches thick and up—							
Pine	12.11	12.65	14.06	14.88	13.21	12.62	13.25
Spruce	9.20	9.75	10.64	11.04	12.24	11.87	10.79
Less than 2 inches thick—							
Pine	8.03	8.59	7.75	7.99	8.91	10.07	8.56
Spruce	3.53	3.92	3.56	3.48	4.70	4.50	3.95
Scantlings and narrow boards, less than 6 inches wide	32.09	31.55	32.77	32.02	35.21	34.89	33.08
2 inches thick and up—							
Pine	5.38	6.92	8.25	7.58	7.71	7.19	7.17
Spruce	4.63	4.91	5.69	6.22	7.05	6.43	5.82
Less than 2 inches thick—							
Pine	12.36	11.65	10.66	11.08	10.76	12.04	11.42
Spruce	9.72	8.07	8.17	7.14	9.69	9.23	8.67
Planed boards:							
8½ inches and up	1.10	1.22	.98	.60	.37	.28	.76
Pine	.47	.48	.36	.32	.22	.19	.34
Spruce	.63	.74	.62	.28	.15	.09	.42
6 to 8½ inches	8.31	8.94	5.27	4.32	2.98	3.19	5.50
Pine	4.24	4.92	2.71	2.13	1.75	2.02	2.96
Spruce	4.07	4.02	2.56	2.19	1.23	1.17	2.54
Less than 6 inches	5.40	6.10	5.09	4.66	4.78	5.28	5.22
Pine	2.99	3.47	2.71	2.40	2.88	3.44	2.98
Spruce	2.41	2.63	2.38	2.26	1.90	1.84	2.24
Total, rough and planed—							
8½ inches and up	21.33	18.50	20.86	21.61	17.97	17.58	19.65
Pine	15.54	13.29	14.76	15.52	11.87	12.30	13.88
Spruce	5.79	5.21	6.10	6.09	6.10	5.28	5.77
6 to 8½ inches	41.18	43.85	41.28	41.71	42.04	42.25	42.05
Pine	24.38	26.16	24.52	25.00	23.87	24.71	24.77
Spruce	16.80	17.69	16.76	16.71	18.17	17.54	17.28
Less than 6 inches	37.49	37.65	37.86	36.68	39.99	40.17	38.30
Pine	20.73	22.04	21.62	21.06	21.35	22.67	21.57
Spruce	16.76	15.61	16.24	15.62	18.64	17.50	16.73

The figures for war years are of little interest because conditions were abnormal and it was extremely difficult to effect any shipments to far-away countries on account of the scarcity of tonnage and the high freight rates.

Exports of timber props and similar stock have been fairly constant during the last 50 years, showing a small increase up to 1904, but the exportation of unmanufactured stock decreased from that time until the end of the war. During the war the exports of pit props and timber, and also railroad ties, increased materially, but this increase was due only to war conditions. The tendency in

UNITED KINGDOM
564,700 M Ft. B.M.
FRANCE
383,540 M Ft. B.M.
GERMANY
246,159 M Ft. B.M.
DENMARK
205,368 M Ft. B.M.
HOLLAND - 114,899 M Ft. B.M.
BELGIUM - 65,344 M Ft. B.M.
SPAIN - 70,975 M Ft. B.M.
NORWAY - 69,088 M Ft. B.M.
ALL OTHER COUNTRIES IN EUROPE, 22,680 M Ft. B.M.
BRITISH SOUTH AFRICA, 65,724 M Ft. B.M.
ALGIERS, TUNIS & MOROCCO, 53,266 M Ft. B.M.
ALL OTHER COUNTRIES IN AFRICA, 42,330 M Ft. B.M.
AUSTRALIA, 38,753 M Ft. B.M.
ALL OTHER COUNTRIES, 16,588 M Ft. B.M.

FIG. 80.—Exports from Sweden in 1913 of rough and planed lumber of pine and spruce, by countries of destination.

Sweden was shown clearly in the exports during the years preceding the war, namely, to manufacture the raw material into sawn or planed lumber products, pulp, etc. Recently the imposition of an

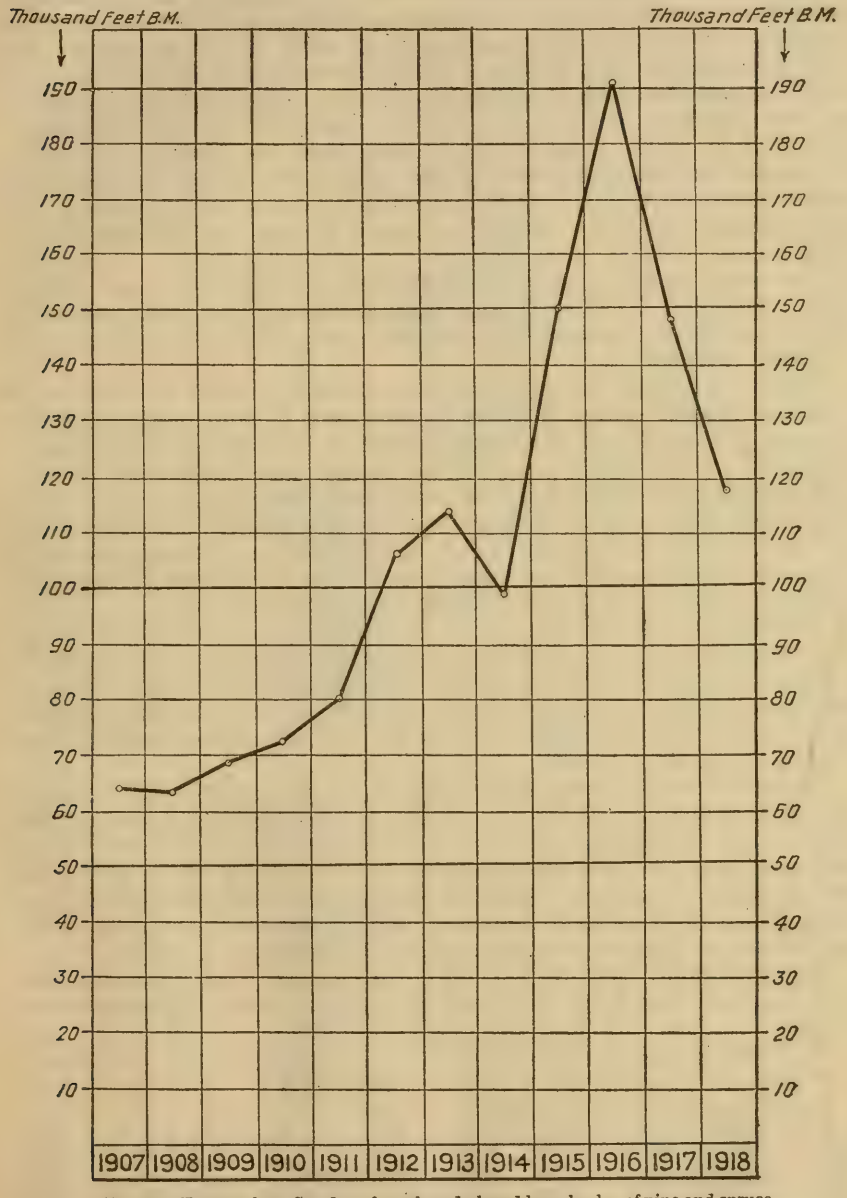


FIG. 81.—Exports from Sweden of rough and planed box shooks, of pine and spruce.

export duty on unmanufactured wood has been considered. During the last 15 years before the war the exports of planed lumber were constant in proportion to the exports of rough lumber, but the former decreased somewhat during the war. The normal propor-

tion of planed lumber to the total exports of rough and planed stock was approximately 15 per cent before the war.

The exports of box shooks in Sweden developed very rapidly during the last 10 years before the war; the quantity of planed and sawn box shooks exported in 1916 was about three times as large as in 1908. The latter increase, however, must be attributed to the war demand for box shooks. The exportation of split wood and mill ends decreased in the same proportion; the quantities exported of this stock in 1916 were less than one-third of the quantities exported in 1908. This clearly shows that the Swedish box factories now are utilizing most of the split wood as raw material for manufacturing shooks in Sweden, while formerly they exported this raw material to other countries, where it was manufactured into such stock.

The exportation of pulp wood showed a similar tendency before the war, and it is believed that pulp wood will not be exported in large quantities, because the Swedish pulp mills themselves need this raw material.

While there has always been and always will be a market for Swedish rough lumber, both in Europe and in countries outside of Europe, the future of the export trade in planed lumber is rather uncertain. One country after the other has practically barred Swedish planed lumber from its markets by imposing on such stock import duties so heavy as to be practically prohibitive. The establishing of direct steamship lines from Sweden to over-sea countries has materially assisted the exporters of planed lumber, as Swedish planed lumber is frequently shipped in small parcel lots.

Immediately before the war such planed stock, shooks, flooring, etc., was shipped in considerable quantities to far-away new markets (India, Persia, Dutch East Indies, South America, etc.). If these markets should be exploited more extensively, the Swedish lumber exporters will doubtless be able to dispose of a large part of their output of planed lumber.

In considering the economic aspect of the Swedish lumber business one must bear in mind that the profits of the Swedish lumbermen are not entirely dependent on sales of sawn and planed lumber. This fact may explain their unwillingness to sell lumber when prices are low, because they are in a position to continue their operations along other lines, such as pulp factories, and, if necessary, to curtail the production of their sawmills in order to stimulate the market.

The remarkable growth in the Swedish export trade in mechanical and chemical pulp from 1892 to 1917 is shown in the following table:

Years.	Mechanical pulp.		Chemical pulp.		Years.	Mechanical pulp.		Chemical pulp.	
	Wet.	Dry.	Wet.	Dry.		Wet.	Dry.	Wet.	Dry.
	Tons.	*Tons.*	*Tons.*	*Tons.*		*Tons.*	*Tons.*	*Tons.*	*Tons.*
1892	27,803	20,654	29,116	12,580	1905	48,735	72,507	239,614	22,980
1893	27,869	20,782	36,869	13,590	1906	53,950	83,396	253,787	23,678
1894	32,410	22,718	35,038	13,204	1907	59,366	114,246	321,470	35,763
1895	33,249	49,680	59,748	9,120	1908	54,414	109,322	362,677	37,333
1896	35,975	65,642	76,934	7,791	1909	45,995	114,495	371,832	31,252
1897	39,791	54,716	80,062	8,350	1910	51,198	180,517	489,004	42,608
1898	47,099	48,841	77,603	7,930	1911	61,203	178,121	562,814	45,390
1899	52,303	41,996	110,763	4,558	1912	57,458	217,746	618,258	55,069
1900	48,403	36,834	132,881	10,426	1913	59,198	264,049	625,716	60,394
1901	42,058	35,636	143,426	10,320	1914	37,806	202,063	630,062	61,086
1902	36,348	61,586	178,333	10,541	1915	57,191	185,825	695,259	53,055
1903	48,734	67,141	224,811	18,017	1916	65,792	223,010	664,112	55,664
1904	58,442	81,392	232,275	20,415	1917	64,175	111,436	478,468	35,103

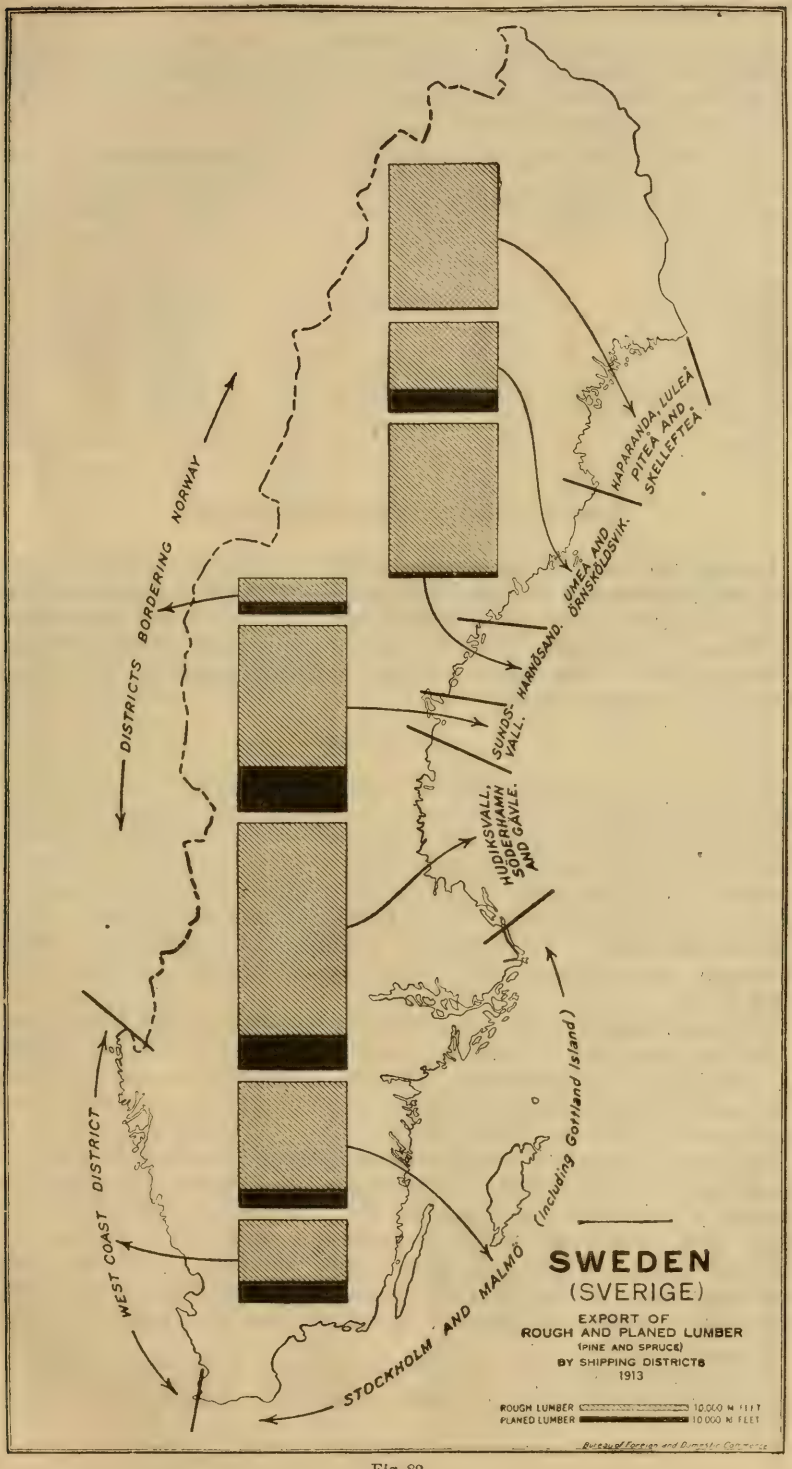

HAPARANDA, LULEÅ, PITEÅ AND SKELLEFTEÅ
UMEÅ AND ÖRNSKÖLDSVIK.
HARNÖSAND.
SUNDSVALL.
HUDIKSVALL, SÖDERHAMN AND GÄVLE.
DISTRICTS BORDERING NORWAY
WEST COAST DISTRICT
STOCKHOLM AND MALMÖ (including Gotland Island)
SWEDEN
(SVERIGE)
EXPORT OF
ROUGH AND PLANED LUMBER
(PINE AND SPRUCE)
BY SHIPPING DISTRICTS
1913
ROUGH LUMBER 10,000 M FEET
PLANED LUMBER 10,000 M FEET
Bureau of Foreign and Domestic Commerce

Fig. 82.

The following table shows the exports of planks, battens, and boards, planed and rough, from Sweden to the principal countries of destination, during the first 8 months of 1913, 1918, and 1919, according to Swedish official statistics (the latest figures available at the time this report was written):

Countries of destination.	January-August, 1913.	January-August, 1918.	January-August, 1919.
	M feet.	*M feet.*	*M feet.*
England	423,463	357,899	630,176
France	205,720	12,642	95,864
Germany	162,588	89,272	7,148
Netherlands	69,575	90,389	48,128
Denmark	146,045	190,983	135,511
Belgium	50,009	671	10,203
Spain	41,511	1,327	32,504
Other European countries	55,163	117,073	118,709
Countries outside of Europe:	137,456	12,264	25,417
Total	1,291,530	872,520	1,103,660

ROUND, HEWN, AND SAWN TIMBER.

During the early part of the lumber export trade round timber and logs represented a large percentage of Sweden's exports of wood. The quantities exported at present are mainly the saw logs shipped to Norway, particularly from regions connected with Norway by floating rivers. The exports of saw logs and round timber to other countries are very small.

MAST TIMBERS.

Sweden was once an important source of supply for mast timber, but now it is difficult to obtain mast timber because most of the virgin forest in Sweden has been cut. It is also very difficult to transport mast timber because logs longer than 30 feet can not be floated in Sweden, as a rule, even in the best-regulated rivers, because the timber is liable to break. Mast timber, therefore, is taken by railroad to the coast. It is usually produced in central and southern Norrland, where the growth of the trees is suitable for stock of this kind.

The specifications for mast timbers sometimes call for timber 50 to 60 feet long and 10 inches in top diameter, but it is very difficult to furnish such dimensions. The use of wooden masts has greatly decreased during recent years on account of use of steel masts in their place. The spar and mast timber supplied at present is of comparatively small dimensions, and is shipped mainly to the United Kingdom, where it is used for masts for small boats, ship rigging, etc. Spruce is principally shipped for this purpose because it is lighter than pine. Scotland takes considerable quantities of masts for fishing vessels. The spars and masts must be perfectly straight and must have no serious defects, such as large knots, which would materially weaken the piece. Stock of this kind must be shipped the year it is cut.

The prices before the war for small masts for fishing vessels were generally 15 to 25 cents per cubic foot, depending upon the dimensions.

POLES.

Small poles called "rickers," mostly of spruce, are shipped in lengths of 16 to 50 feet, having a top diameter of 1½ to 3 inches and a diameter at the middle of 3½ to 6½ inches. This stock is shipped mostly to the United Kingdom. The poles must be straight and have no serious defects. They are shipped with the bark on. This stock is used mostly for scaffolding in various industrial plants. The following table shows dimensions and prices for such small poles in 1913:

Lengths.	Top diameters.	Price f. o. b. west coast port (1913).
Feet.	*Inches.*	*Cents per cubic feet.*
16–22	1½	10.7
22	2	20.1
23–30	2	25.5
22	2½	24.1
24	2½	29.4
25–29	2½	40.2
30–35	2½	58.9
36–40	2½	67.0
42–48	2½	93.8

The United Kingdom and Denmark are the principal markets for telegraph and telephone poles. This stock is not shipped in any great quantities from Sweden because the specifications in the United Kingdom are very strict and frequently result in claims, which make the exportation of this stock unprofitable. The poles must be felled between November 15 and March 15, according to the British specifications. The taper of the Swedish pine is generally not suitable for telegraph and telephone poles of the required dimensions. For instance, when the specifications stipulate an 8 inch inch diameter at the butt and a 6 inch diameter at the top, the Swedish poles would be 7½ inches at the butt and 6 inches at the top. The growth of the Norwegian pine is more suitable for telephone poles and this trade, therefore, is handled largely by Norway. It is difficult in Sweden to obtain telegraph and telephone poles more than 50 feet long if they must comply otherwise with the British specifications.

The following are typical specifications for telegraph and telephone poles from southern Norrland to the east coast of the United Kingdom in 1913:

Lengths.	Top diameters.	Minimum diameters, 5 feet from butt end.	Prices c. i. f. east coast, United Kingdom.
Feet.	*Inches.*	*Inches.*	*Per piece.*
18	5½–6½	7¼	$0.973
20	5½–6½	7½	1.095
22	5¾–6¾	7¾	1.277
24	5¾–6¾	8	1.642
26	5¾–7	8¼	1.947
28	5¾–7	8½	2.190
30	6 –7½	8¾	2.433
34	6½–7¾	9¼	3.042
36	6½–7¾	10	3.407
38	6½–7¾	10½	4.380
40	6 –7½	9¾	5.110
45	6½–8	10¾	6.083
50	6½–8½	11½	8.030
55	7 –8¾	12½	10.950
60	7 –8¾	13½	14.840
65	7 –9	14	17.760

MINING TIMBER.

The United Kingdom is the principal market for round mining timber. This stock is of rather poor quality, admitting discoloration, a certain amount of rot, large knots, etc.—in other words, stock that is not suitable for the sawmills. The mining timber is usually barked and shipped in lengths of 10 feet and up, generally 17 to 18 feet. The top diameter varies from 4 to 7 inches. This stock was sold before the war at about 7 to 8 cents per cubic foot. The exports are unimportant.

Pit props are used in the mines for various purposes, supports, etc., and are shipped mainly to the United Kingdom.

The shipment of props from Sweden is effected either direct or by way of Norwegian ports. During the last 10 years before the war the exports of props declined about 50 per cent on account of the increased use of such stock by the pulp mills in Sweden. Both pine and spruce and some birch props are shipped. The birch props are used in the manufacture of bobbins.

Of pine and spruce props there are two kinds, long and short props. The long props are 3 inches in top diameter and are 10 feet and up in length. The average length is generally 14 to 16 feet. This prop is usually crosscut to suitable size at the mines. Short props are shipped in lengths from 2½ to 8 or 9 feet.

The general rules in connection with prop shipments stipulate that the number of feet in length must not be less than the number of inches in top diameter. The props are shipped either barked or with the bark partly stripped.

Props are usually sold by the cubic fathom, or 216 cubic feet. The prices before the war varied a great deal because prop shipments are usually handled by small exporters and speculators who have not regulated their output or prices.

Much unfavorable comment is heard in Sweden about the system of measuring props in the importing countries, and there seems to be and urgent call for some kind of official institution for measuring props, such as has been established in Norway with very satisfactory results. The Swedish prop shippers have been more or less in the hands of the importers, as the props frequently have been paid for on the basis of measurements taken in the importing countries.

The prices before the war generally averaged about $11.50 per cubic fathom, f. o. b. central and southern Norrland ports, and $14.50, f. o. b. west coast of Sweden. During the war the prices for props advanced materially and as much as $50 to $55 was paid f. o. b. west coast of Sweden.

The production of props has been for many years a menace to the Swedish forests, but by the new forest law the production of props is greatly curtailed. Such stock from now on will be produced mainly from timber cut in accordance with the improvement-thinning cutting system or from top logs, etc. It is believed that the shipments of props from Sweden will decline materially in years to come; and as laws similar to the Swedish are in effect in Finland, the production of props will probably be transferred to Russia, where the cutting regulations are less strict.

Props are sometimes cut in two and exported. For instance, from logs 4½ and 5 inches in top diameter, two pieces, 2¼ by 4½ and 2½ by 5 inches, are obtained. The length varies from 4½ feet and up;

it is usually 6 feet. This stock is usually shipped to the United Kingdom.

PULP WOOD.

It is natural that a country like Sweden with an important pulp industry can not have any large quantities of pulp wood for export, because the Swedish pulp factories are in need of very large quantities of this material. The pulp wood exported from Sweden goes almost exclusively to Norway, and is shipped only from such regions as are more accessible to Norwegian points than to the nearest Swedish pulp mills.

HEAVY SQUARE TIMBER.

Heavy square timber may be defined as timber 9 or more inches square at the middle. The lengths are 18 feet and more. This stock is shipped mostly from the west coast of Sweden and the northern parts of Norrland to Denmark and Germany. Pine is generally preferred. For reasons previously stated, the supply in Sweden of this kind of timber is not very large. The maximum dimensions obtained in any part of Sweden may be said to be 15 to 16 inches square at the middle, and 50 to 60 feet long. Such stock, however, is extremely rare and would command heavy prices. The customary dimensions of heavy square timber are 9, 10, 11, and 12 inches square at the middle. The average length is about 22 feet. The average cubical contents, upon which basis the timber is sold, is generally 30 to 35 cubic feet. The timber is hewn in such a way that the piece is given a conical shape. The difference in the measure at the butt and at the top is generally 1 to 3 inches, depending upon the length. The timber is cut on the half foot in length and measured on the quarter inch in square.

Considerable wane is allowed, extending from the middle of the piece toward the top. For instance, timber 10 inches at the butt may have $6\frac{1}{2}$ inches of hewn surface at the top. The rules in regard to the wane vary greatly, however, with different shippers and different markets.

The timber is graded into two grades, first and second, but very small quantities of second-grade timber are shipped. The requirements in regard to first-grade stock are rather indefinite, but the general stipulation is that the timber must have no defects that would materially weaken it. No large or rotten knots, no discoloration, and no heart shakes are admitted. The timber is generally stored under water to prevent checking.

The prices obtained before the war, f. o. b. central Norrland ports, were approximately $0.40 per cubic foot, based on timber of 30 cubic feet, and in 1918 about $1.35 per cubic foot was paid for the same dimension.

HEWN AND SAWN SMALL TIMBER.

Northern Norrland and the west coast of Sweden are the principal producers of hewn and sawn small timber, and it is shipped to the United Kingdom, France, Germany, Denmark, and Egypt, and a few other countries. Both pine and spruce small timber is cut and shipped in one quality only. The small timber must not have so many nor so large knots as the heavy timber. The stipulations in regard to this stock vary greatly in the different countries to which it is shipped.

The United Kingdom requires that the difference in measurement between the butt and the middle must not exceed 2 inches. If the quality of the small timber is good, wane up to one-third of the length of the piece, measured from the top toward the middle, may be allowed. For instance, timber 6 inches square at the middle may be 4 inches square at the top. The dimensions shipped to the United Kingdom vary from 4 to 6 inches square at the middle and the lengths from 12 feet and up.

To Egypt, Germany, and Denmark small timber is shipped hewn, sawn, or planed in dimensions ranging from 3 by 3 inches and up. Denmark takes mostly pine stock, both hewn and sawn, but this market is rather strict in regard to the wane on sawn small timber. Hewn stock, on the other hand, admits of a large amount of wane. The small timber must be bright and dry and have no serious defects. The average length is about 15 feet. The hewn timber may admit of a larger amount of defects than sawn timber, but, on the other hand, the average length of hewn timber must generally be somewhat greater than that of sawn timber.

To Germany a special stock called "Kantholz" is shipped, both of pine and spruce. Spruce, however, is preferred on account of the duty, which is based on the weight. The German importers prefer to have the stock sawn according to metric measurements. For such special sawn stock extra charges are naturally made by the Swedish exporters. The average lengths of "Kantholz" are 15 to 16 feet. This stock may contain a large amount of wane; it may be stated in the contracts that the only requirements in this regard are that the saw must have touched all four sides of each piece.

The small timber shipped to Egypt is of rather inferior quality and admits of a large amount of wane. This stock, however, must be bright and dry. For Egyptian small timber both pine and spruce are used and the stock is hewn. The dimensions vary considerably and the lengths are generally 12½, 15¾, 18¾, 22, and 25 feet.

Following are the items in a typical shipment of 1,000 pieces of this small timber to the Egyptian market:

Lengths.	Width and thickness.	Pieces.
Feet.	*Inches.*	
12½	3 by 3	170
	3 by 4	120
	4 by 4	110
	4 by 5	70
15¾	3 by 3	50
	3 by 4	50
	4 by 4	150
	4 by 5	100
18¾	3 by 3	10
	3 by 4	10
	4 by 4	90
	4 by 5	50
22	4 by 4	5
	4 by 5	5
25	4 by 4	5
	4 by 5	5

The prices of small timber, f. o. b. Norrland ports, were as follows before the war: Kantholz for Germany, measuring 4 by 4 to 6 by 6 inches, sold at 13.1 cents per cubic foot; 6 by 7 to 8 by 8 inches, 14.3 cents per cubic foot. These prices were based on timber 18 feet and

more in length; shorter lengths were two-thirds of these prices. Small timber for Egypt varied in price from 10 to 12 cents per cubic foot. Small timber for France from 4 to 5¾ inches square sold at 17 cents per cubic foot; 6 to 6¾ inches square, 18 cents; 7 to 7¾ inches square, 20 cents; and 8 inches square, 21 cents. These prices were based on lengths 18 feet and up. Shorter lengths were sold at two-thirds of these prices. Small square timber for the United Kingdom generally commanded 12 cents per cubic foot in lengths of 18 feet and up. Shorter stock was sold at two-thirds of this price. Small timber for Denmark was generally sold at 25 to 30 cents per cubic foot, according to dimensions. During 1918 the average prices for small timber ranged from 60 to 85 cents per cubic foot. The following is an example of prices for the Danish market in 1918: 3 by 4 inches, 60 cents per cubic foot; 4 by 4 inches, 61 cents; 4 by 5 and 5 by 5 inches, 64 cents; 5 by 6 and 6 by 6 inches, 67 cents; 6 by 7 and 7 by 7 inches, 69 cents; 8 by 8 inches, 76 cents; 9 by 9 inches, 85 cents.

The output of small timber may be affected seriously by the new forest laws in Sweden, which will restrict the cutting of young forests.

RAILROAD TIES.

The exports of railroad ties from Sweden are not important, as even the Swedish railways at times have difficulty in obtaining the necessary material of this kind. The Swedish Government, therefore, had to construct a sawmill for cutting ties, producing about 1,000,000 ties annually.

The United Kingdom and Denmark are practically the only markets for Swedish ties, which are usually produced on the west coast of Sweden. The ties shipped to England are generally used in the mines. (The dimensions of the ties have been given under the section on "Sawmilling.")

Ties produced by private mills in Sweden for domestic consumption contain 3½ cubic feet, and the following average prices have been obtained during the last five years: 1914, $0.67 per tie; 1915, $0.723; 1916, $0.938; 1917, $1.206; 1918, $1.742.

The ties exported to Denmark are somewhat smaller than the ties used in Sweden and the price paid in 1918 was $2.15 per tie delivered f. o. b. Swedish west-coast ports.

MARKETS FOR SWEDISH LUMBER EXPORTS.

During the years immediately previous to the war Sweden expanded its activities over a larger field abroad. When the war broke out this development of the lumber export trade to countries outside of Europe was curtailed to a great extent.

The following table shows the percentage of the Swedish exports of planed and rough lumber (pine and spruce), including box shooks, that was sold to each continent from 1905 to 1916:

Continents.	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916
	Perct.	*Perct.*	*Perct.*	*Perct.*	*Perct.*	*Perct.*	*Perct.*	*Perct.*	*Perct.*	*Perct.*	*Perct.*	*Perct.*
Europe	94.1	94.1	93.3	91.0	91.4	86.6	85.9	87.2	87.2	91.7	96.9	97.2
Africa	5.2	4.8	5.5	7.1	6.5	9.6	9.3	9.0	9.5	5.5	2.5	2.6
Asia	.1	.1	.1	.1	.3	.5	.6	.8	.4	.4	.1	.2
Australia	.4	.6	.6	1.4	1.3	2.6	3.1	1.8	2.3	2.0	.4	.0
America	.2	.4	.5	.4	.5	.7	1.1	1.2	.6	.4	.1	.0

A detailed statement in regard to the percentage of rough lumber and planed lumber exported to the different continents may be found in the appendix.

SHIPPING CONDITIONS.

While the ports on the western and southern coasts of Sweden are open the year round, this is not the case with the ports facing the Baltic and the Gulf of Bothnia. Large stocks of lumber are therefore accumulated during the winter for shipment by the first open water. These stocks usually aggregate about 1,000,000,000 board feet when navigation opens in the spring. In late years, however, the southeastern ports of Sweden have been kept open by ice breakers, but the lumber shipments for export from these ports are not very important. The shipping season of the principal lumber-exporting districts does not start until the end of April, at which time the southern Norrland ports are open to navigation.

During the month of May the other ports lying north of this district can resume shipping, which is carried on until the water freezes sometime in the late fall, about the middle of November in the northern ports. In the southern Norrland ports navigation may be open until the latter half of December.

The following schedule gives an approximate idea of the percentages of a normal year's exports of lumber from Sweden shipped during the different months:

	Per cent.		Per cent.
January–May	24	September	11
June	11	October	13
July	13	November	10
August	11	December	7

The Swedish ports are very satisfactory and are usually protected by islands. The tidewater in the northern ports does not interfere at all with the shipping, as the Gulf of Bothnia may be considered almost an inland sea.

While in Norrland and on the east coast lumber exports are usually effected by vessels during normal times, southern Sweden ships important quantities by rail to Denmark. This market is supplied by many small mills in southern and central Sweden catering to this trade and the lumber is taken across the narrow sound on ferryboats. During the war this rail shipment increased on account of the high ocean freight rates and heavy insurance premiums demanded. Even the mills up in southern and central Norrland shipped lumber in this way to Denmark.

Considerable quantities of lumber are shipped to Norway by rail during normal years from interior mills located at a distance from Swedish ports. The rail shipments to Norway increased very materially during the war. While the average normal quantity of lumber shipped by rail to Norway was about 90,000,000 feet board measure, this quantity nearly doubled during the latter part of the war. A large percentage of the Swedish lumber exported to Norway is consumed in that country, but probably most of it is planed or otherwise manufactured and reexported.

The natural outlet for Swedish lumber from Norrland is by water, and as soon as normal conditions are restored rail shipments will

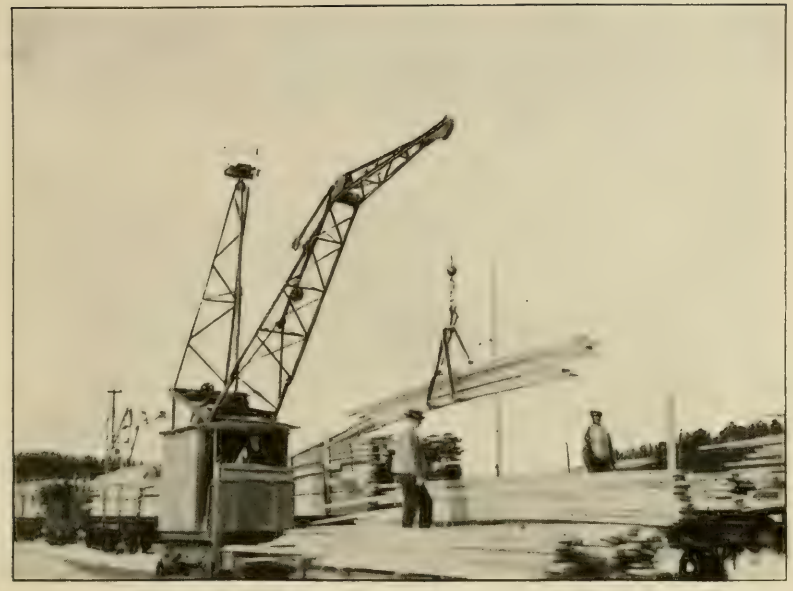


FIG. 83.—PILING WITH CRANES.

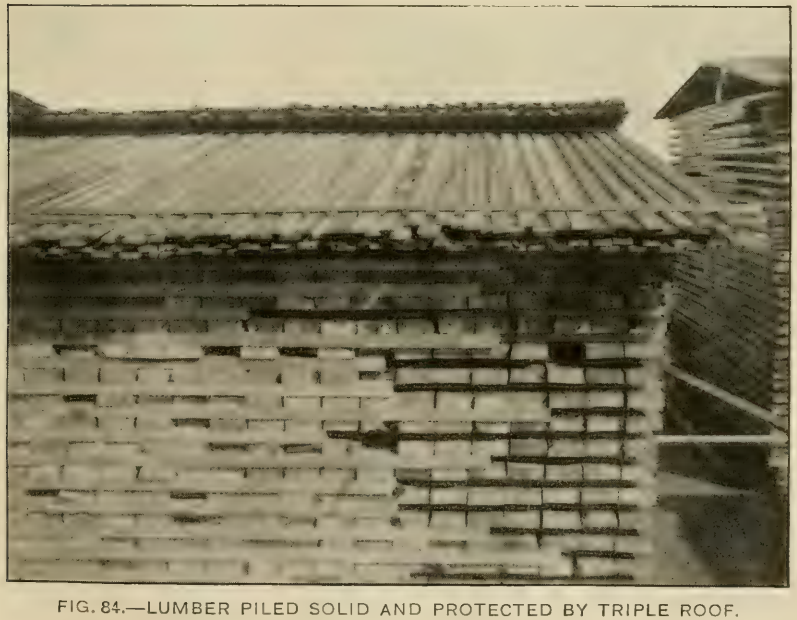


FIG. 84.—LUMBER PILED SOLID AND PROTECTED BY TRIPLE ROOF.

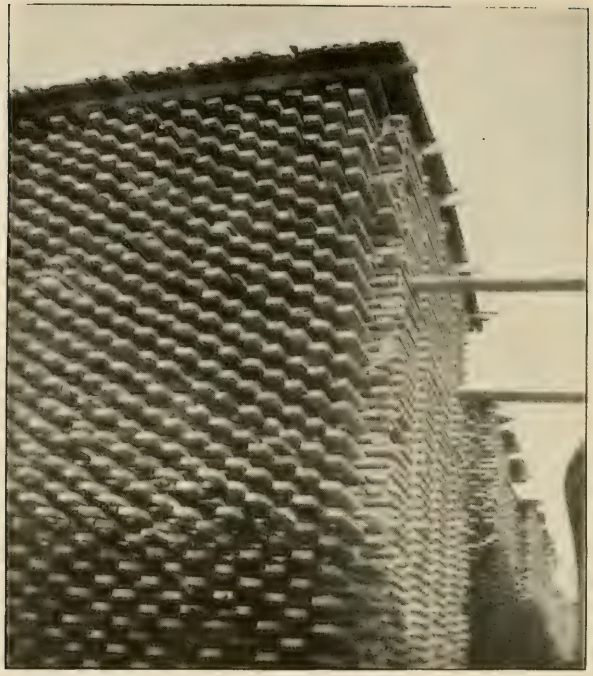


FIG. 85.—PILING LUMBER SO AS TO LEAVE ENDS 3 OR 4 INCHES LONG PROTRUDING FROM PILE.

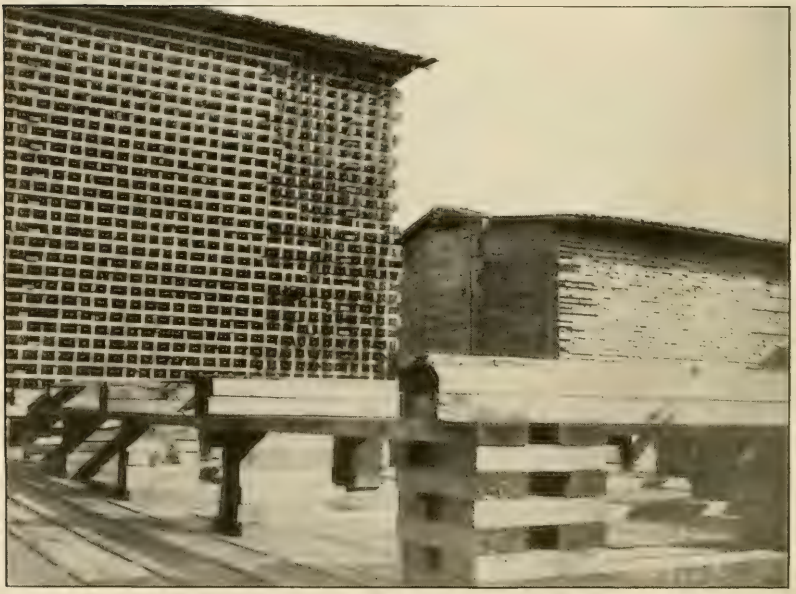


FIG. 86.—METHOD OF PILING WITH HIGH BASE AND PERFECTLY CLEAN BOTTOMS.

decrease. There will always be some rail shipments to Norway and Denmark, however, from certain interior mill districts in Sweden.

Owing to the difficult conditions in regard to shipping during the war, several mills in Norrland shipped important quantities of lumber on barges inside the 3-mile limit to southwestern Sweden and stored the lumber in the ports until the following winter, when the prices went up on account of the limited quantities available for shipment from the parts of Sweden with ports open the year round. This shipping system was very expensive, as the storage charges on the west coast were heavy and usually very small profits, if any, resulted. This system was discontinued by most of the firms toward the end of the war. It must be considered as a war measure only.

Some mills also tried to reach foreign markets via Norwegian ports, but the difficulties in regard to securing storage space for lumber and the high charges for transshipment prevented the Swedish exporters from making much of a success of this undertaking. There may have been also, in many cases, obstructions on the part of Norwegian exporters who did not like to see the Swedish lumber pass out of their hands by being shipped direct.

Owing to the shortage of coal and cars during the war, the Swedish Government made a ruling that lumber could be shipped by rail only through its regular channels before the war and besides compensation in coal was demanded in case of such rail shipments.

RAILWAY FREIGHT RATES.

Before the war the cost of shipment by rail during the winter from the mills on the Wenner Lake to Goteborg was approximately $2 to $3.50 per 1,000 feet board measure. In 1918, the charges were $7.50 to $10. These charges include loading on cars, railroad freight, and transshipping to steamer in Goteborg.

The charges per 1,000 feet board measure for transshipment of planed and rough lumber, held for different storage periods in the port of Goteborg, were as follows:

Storage periods.	Planed lumber.	Rough lumber.	Storage periods.	Planed lumber.	Rough lumber.
15 days	$2.17	$2.03	45 days	$4.12	$3.86
25 days	2.79	2.50	60 days	5.15	4.87
35 days	3.45	3.18	90 days	7.04	6.78

In some cases, both during and before the war, lumber was shipped by rail to Goteborg even from points in central Norrland. The rates before the war, including storage charges in Goteborg, were about $4.50 to $5.25 per 1,000 feet and in 1918 about $21.50.

The rates for shipment of planed lumber from the sawmill districts in Jemtland, in the interior of central Norrland, to the Norwegian port of Trondhjem were $1.35 to $1.50 per 1,000 feet in 1913, and $4 to $4.50 in 1918. For rough stock the charges were $1.55 to $1.65 in 1913 and $5.25 to $7 in 1918.

On August 1, 1919, another heavy increase was made in railroad freight and the present rates in Sweden represent about 250 per cent increase above the pre-war rates. This has had a very serious effect

on rail shipments in Sweden and has also affected the charcoal industry to such an extent that many mills have been forced to discontinue the operation of their charcoal plants.

STEAMSHIP LINES AND TONNAGE QUESTION.

While the Swedish west-coast shippers have enjoyed the benefits of direct liners, the Norrland ports have not been in the same favorable position. Only a few liners at times touched the Norrland ports before the war, as the steamers generally managed to obtain full cargoes in southwestern Sweden and in southeastern Norway. Before the war the west coast of Sweden had steamship connections with practically every important lumber market in the world, as is shown by the following list of countries served by steamers from Goteborg: France (Channel, Bay of Biscay, and Mediterranean ports); Belgium, the Netherlands, United Kingdom (east, south, and west coasts), Denmark, Norway, Germany, Spain (Bay of Biscay and Mediterranean ports), Portugal, Italy, Balkan ports, and the Levant, South America (east and west coasts), British India, Dutch East Indies, Persian Gulf and Red Sea ports, Canary Islands, North Africa, South Africa, East Africa, West Africa, and Australia. Some of these lines were Norwegian and some were of other nationalities, but the Swedish shipowners greatly developed this system of regular steamship lines during the last few years before the war. The war interrupted this development, but during 1919 most of the old-established lines resumed operations and several new lines were established, while others are contemplated. The Swedish and the Norwegian steamship lines closely cooperate in regard to the expansion of their activities. Some of the Swedish steamship lines had Government subsidies before the war, but during the war several of them voluntarily returned the amounts received from the Government.

Sweden has not at present suitable timber for shipbuilding purposes, and the art of building wooden ships is almost forgotten. A type of smaller vessels has been inaugurated lately by one mill in the Wenner district, having access to the ocean through the canal in the Gota River. The boats built for this mill have a capacity of 600,000 to 800,000 feet board measure and are equipped with auxiliary motors. Such ships can easily cross the North Sea, and it is even planned to have them go as far as the Mediterranean countries, so that the cargoes will not have to be transshipped in Swedish ocean ports. It is almost certain that this type of steamer will be found very suitable, as they can easily reach European ports where larger steamers have difficulty in entering.

Other mills have constructed barges of a larger capacity provided with auxiliary oil-burning engines.

For many years plans have been under consideration to keep the Norrland ports open to navigation the year round by ice breakers. Although this plan has not yet been fully realized, the shipping season has been extended every year by means of ice breakers.

In 1918 this movement was again started and received official support. It was planned to establish a service of powerful ice breakers along the Norrland coast, assisted by a series of local ice breakers, and it was expected to have all important ports open at least through the greater part of the winter. If this scheme is successfully carried

out in the future, it will have an important influence upon the market, as Sweden will then be enabled to ship lumber the year round.

The plan has many practical difficulties, however, and it may not benefit the lumber industry to such an extent as is generally believed. Lumber can usually be loaded only from barges, and it will be very difficult and in many cases almost impossible to load in this way during the winter. For the pulp mills, on the other hand, such a plan would be of the utmost importance, as the vessels may load from the dock.

The districts around Lake Wenner in central Sweden are in an especially advantageous position in regard to shipping. A system of canals connects this lake and the surrounding water systems with the Cattegat, and ships up to about 1,500 tons may pass through this canal and load at the mills on the northern shore of the lake. Lake Wenner has an area of about 2,400 square miles and borders on a very important lumber region. It is planned to employ ice breakers in the canal and on the lake to keep navigation open the year round.

RAFTING OF SAWN LUMBER.

In 1918 a Swedish company, Aktiebolaget Refanut, was organized in Stockholm to exploit the patents of rafting sawn lumber. The idea of rafting sawn lumber is new, although rafting logs has been practiced for a long time on the Pacific coast of the United States, and in Finland and northern Sweden. Aktiebalaget Refanut conceived the idea of extending the rafting to sawn lumber during the war; in pre-war days the freight rates had been so low that there seemed to be a limited call for such a system. During the war freight rates advanced to such a height that the northernmost districts on the Gulf of Bothnia found it exceedingly difficult to have their stocks shipped, and many companies had more than 50 per cent of the annual production in their yards at the end of the shipping season. The time seemed opportune for an attempt to raft sawn lumber, and during the autumn of 1918 a huge raft containing approximately 4,200,000 board feet of sawn lumber, consisting mainly of fifth-grade stock, was towed from Haparanda district in northern Sweden to Copenhagen, a distance of about 1,000 miles. This raft was 365 feet long, 50 feet wide, and 25 feet deep, and had a draft of 15 feet 5 inches. It was constructed very solidly and bound with steel wire. The raft arrived in good condition, and the first attempt to raft sawn lumber was accomplished successfully.

As this matter of rafting is of vital importance to the lumber exporters in the United States, where attempts have been contemplated to raft lumber across the Atlantic, it may be of interest to consider a report made by Lloyd's surveyor in Stockholm in this connection. An extract from this report reads as follows:

> The bottom structure of the raft consists of four tiers of longitudinal beams or girders, each consisting of two tiers of 8 by 6 inch pine beams, bolted, the one tier on top of the other, by means of 1-inch screw bolts. These girders are connected crosswise by means of 8 by 8 inch beams and 1½-inch screw bolts at the crossings.
>
> Forward and aft this bottom structure is pointed, the angles at both ends being 60°.
>
> On this bottom frame the first layer, consisting of 11 by 4 inch deals, is laid longitudinally, with the butts well shifted. The next, or second, layer is laid on top of the longitudinal layer at an angle of 30° on one side. The next, or third, layer is laid on top of the second one at an angle of 30° with the longitudinal direction, but on the opposite side. The next, or fourth, layer again is laid longitudinally, and so on.
>
> In addition, a few layers are dispersed throughout the body of the raft at right angles to the longitudinal direction.

It is assumed that by this distribution of the component tiers of the raft the longitudinal or bending stresses in the body, caused by the action of the waves, weight of deck cargo, etc., will be absorbed by the longitudinal tiers, whereas any tendency toward "corkscrewing" in a seaway, caused by waves striking in an oblique direction, will be counteracted by the diagonal and athwartship tiers.

Aktiebolaget Refanut's object was to test the question whether, practically speaking, the natural adhesion between the surfaces of sawn wood was sufficient, if supplemented by a reasonable amount of cable bindings, to withstand the disintegrating effect of long sea voyages, and it must be said that the result was satisfactory under the conditions encountered in the Baltic.

To quote again from Lloyd's report:

In the southern part of the Baltic, however, a sea rose 2 to 3 meters (7 to 10 feet) in height, and then the midship portion of the raft was found to rise and drop relatively on both ends within the limits of 2⅜ and 4½ inches between the extreme positions, thus showing that an actual deflection from the horizontal line of the deck took place of 4¾ inches as a maximum, a deflection which is thus practically equal to the deflection of the bottom, caused by a deck load of 198 tons, as ascertained through the soundings above recorded.

The observations appear to corroborate the opinion of the originator and the designer that the internal pressure between the component parts of the raft is sufficient for practically altering the friction or adhesion between these parts so much that it may be considered equal to the cohesion in a solid log or beam. In particular, the good elastic properties of the main body of the raft, if the weak, pointed ends be disregarded, is really striking and appears to support this theory materially.

Finally, Lloyd's report on the underwriting point of view states:

That rafts, of the general design shown on the appended plan, appear to possess sufficient rigidity to resist the action of even a fairly rough sea;

That the waves of about 10 feet in height, encountered on this first voyage with a lashed raft of sawn wood, termed "refanute," when striking against the bow and sides, have not caused any damage whatever;

That the working in a seaway of this raft more than 328 feet in length, and the periodical deflections from the horizontal of the main body of the raft between the wedge-shaped ends, are insignificant and probably less than those that may be observed on the hull of a cargo steamer of the same length, loaded with heavy cargo;

That the permanent set of the deck line is practically nil; and

That the network of steel wires has been found to be judiciously dispersed over the surface of the raft and has actually prevented any part of the surface wood from coming adrift or even loosening the firm adherence to the adjacent parts of the "refanute," which appears to be the "springing point" and the underlying principle of this new kind of transportation of sawn wood.

Provided that Aktiebolaget Refanut can satisfy underwriters that the same conscientious attention to details of stowing and binding together be given to future constructions, as has been bestowed on the "Refanut I," I consider the risk on insurance of this kind of craft—apart from the fact that about five-eighths of the "cargo" is or may be soaked with water from the outset—little if at all greater than that on the large deck cargoes of sawn wood, usually carried across the North Sea.

But I beg to emphasize that I do not recommend promiscuous insurance of this kind of craft, irrespective of its origin and construction. I understand that Aktiebolaget Refanut is patenting the main features of the new construction and have registered the name "Refanut" in different countries. Their future rafts, or "refanutes," will all bear this name with consecutive numbers, so that even their name will become a kind of guaranty of a certain type of raft and class of work in its construction.

While a raft of logs once broken is hopelessly dispersed, sawn lumber has often shown an astonishing cohesion, and it is believed that in case of accident, the greater percentage of such rafts could be salvaged. Naturally the lumber will suffer somewhat from sea water, but recent improvements made on the Refanut will overcome these difficulties to a great extent. It is claimed that the freight on this raft from northern Sweden to Copenhagen was only one-fifth of

the freight rates for the same quantity of lumber carried in the regular way.

Early in the spring of 1919 a raft of sawn lumber, constructed on lines similar to the Refanut, was transported from Trondhjem in northern Norway to the east coast of the United Kingdom. Although the North Sea, which is very shallow, is one of the most difficult crossings to make, this rafting turned out successfully.

It appears that Aktiebolaget Refanut Co. intends to make further experiments to perfect this system and that this question has already been taken up with American interests by the Swedish company.

Figure 108 shows the construction of the first Refanut, which was towed to Denmark.

OCEAN FREIGHT RATES.

Although the pre-war freight rates will probably never obtain again, it may be of interest to see how the low rates then prevailing enabled the Swedish exporters to reach such far-away countries as Australia and South Africa.

The freight rates before the war were fairly stable. Many ports in Sweden enjoyed the privilege of having direct liners to the principal foreign markets, and a large percentage of the lumber shipped from the west coast was sent on the regular liners. The freight from the west-coast district to the east-coast ports of the United Kingdom at times was as low as $1.25 to $1.50 per 1,000 feet board measure, but the rates from the Baltic and Gulf of Bothnia ports were somewhat higher. On an average the freights per 1,000 feet board measure from the Hernosand district to various destinations were about as follows before the war:

United Kingdom east-coast ports	$2.50–$3.30
Germany	1.75– 2.25
Netherlands and Belgium	2.75– 3.00
France (Channel ports)	2.80– 3.25
Northern Spain	4.00– 5.00
Mediterranean ports (Spain and France)	7.00– 8.50
Other Mediterranean ports	7.50– 8.50
Northern Africa	$7.50–$9.00
Canary Islands	6.14
Algoa Bay and Cape Town	11.00
East London and Durban	12.25
Delagoa Bay	12.50
Freemantle	10.50
Adelaide	10.25
Melbourne and Sydney	9.85

The freights from the Swedish west coast to South Africa and Australia were $1.25 less. The rate from the Hernosand district to Melbourne and Sydney by sailing vessel was $7.35 per 1,000 feet.

In many cases very low rates could be obtained on lumber from the west coast, especially when steamers desired parcel lots to complete a cargo. The record rate is said to have been obtained a few years before the war broke out, when a steamer was chartered to load at five different mills in the Hernosand district for the United Kingdom east-coast ports at about $2.08 per 1,000 feet.

The difference in freight between the various ports in Norrland and the southeastern coast of Sweden was not very large before the war. Between the ports in the upper-gulf and in the Hernosand district, the difference in freight would be about $0.61 to $1.23 per 1,000 feet. The difference between the Hernosand district and the lower-gulf district did not vary very much—at times about $0.61 per 1,000 feet.

A large percentage of the lumber exported, particularly to the Mediterranean countries and the British colonies, was shipped in sailing vessels. Most of the lumber to South America was shipped

from Goteborg on the west coast by the regular liners between this port and South America. The freight rates from Goteborg or Stockholm to the various ports in South America in 1913 were about as follows, per 1,000 feet board measure: Pernambuco, $14; Rio de Janeiro, $11; Santos, $12; Bahia Blanca, $18.50; Montevideo, $9.50; Buenos Aires, $9.50.

Deck cargoes were sometimes shipped at two-thirds of the regular rates to the Mediterranean countries and a few others, but in most cases deck cargoes paid full freight. Short lumber (6, 7, and 8 feet), constituting 3 to 5 per cent of the cargo was sometimes freighted at two-thirds of the regular rate on sailing vessels, but on steamers full freight was always paid.

During the war the freight rates increased many times and even $50 to $60 per 1,000 feet board measure was paid for lumber cargoes from Goteborg to the east coast of the United Kingdom. However, these freight rates are of no interest at the present time, as they were abnormal. It is difficult to pronounce anything definite upon the freight rate for the future, as this question is very unsettled. Recently the Swedish shipowners entered into an agreement with the United Kingdom with regard to tonnage and the following rates per 1,000 board feet applied for lumber shipped from Sweden to that country (October, 1919): Hernosand to east coast ports of the United Kingdom, $21.80; Hernosand to west coast ports of the United Kingdom, $23.05; Swedish west coast ports to east coast ports of the United Kingdom, $12.90. For other European countries the freight rates vary from one day to another. From the Swedish west coast ports to northern France, about $19 to $20 per 1,000 feet, board measure, is generally paid, and to the same markets from Hernosand about $30. To the Netherlands and Belgium the rates are somewhat lower; for the Netherlands the rate is about $25 from Hernosand.

It is estimated that the higher the freight rates the better opportunity the Swedes have for controlling European markets, without competition from countries outside of Europe; and by the time freight rates have come down to reasonable figures, the Swedish lumber exporters will have the advantage of several new steamship lines.

MARINE INSURANCE.

The insurance rates differed considerably before the war during the various seasons of the year. On an average, the premium paid was about ¼ of 1 per cent to 1½ per cent during normal times. For sailing vessels the charges were heavier. During the war 10 per cent premium for marine insurance was not an unusual charge and even as high as 30 per cent was paid in March, 1917, from Goteborg to United Kingdom east coast ports. Since the armistice, the rates of insurance have come down to about the pre-war level.

The following table gives the normal marine-insurance rates at various seasons, affecting lumber cargoes from the east coast of Sweden, to the principal markets:

Dates of shipment.	To east coast of United Kingdom.	To west coast of United Kingdom.	To western France, Bay of Biscay ports, Portugal and south coast of Spain east to Gibraltar.	To Mediterranean countries.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Apr. 1–July 31	5/16	3/8	1/2	5/8
Aug. 1–Aug. 10	5/16	3/8	1/2	5/8
Aug. 11–Aug. 15	1/2	5/8	3/4	5/8
Aug. 16–Aug. 20	3/8	5/8	3/4	5/8
Aug. 21–Aug. 31	7/16	7/16	5/8	7/16
Sept. 1–Sept. 10	5/8	3/4	1	1 1/8
Sept. 11–Sept. 15	3/4	7/8	1 1/8	1 1/4
Sept. 16–Sept. 20	3/8	1	1 1/4	1 3/8
Sept. 21–Sept. 25	1	1 1/8	1 3/8	1 1/2
Sept. 26–Sept. 30	1 1/4	1 3/8	1 1/2	1 5/8
Oct. 1–Oct. 5	1 3/8	1 1/2	1 1/2	1 5/8
Oct. 6–Oct. 10	1 3/8	1 1/2	1 3/4	1 7/8
Oct. 11–Oct. 15	1 1/2	1 5/8	1 3/4	1 3/4
Oct. 16–Oct. 20	1 1/2	1 5/8	1 3/4	1 3/4
Oct. 21–Oct. 25	1 3/4	2 1/4	1 7/8	2
Oct. 26–Oct. 31	1 3/4	2 1/4	2 1/4	2 1/4
Nov. 1–Mar. 31	2	2 3/8	2 3/4	2 1/2

The rates from the east coast of Sweden to the channel ports of France and England were usually the same as for the east coast of the United Kingdom.

The rates to South Africa were generally about 10 per cent higher, and the rates to South America and Australia about 15 per cent higher than the rates to the Mediterranean countries.

SHIPPING REGIONS.

Ever since the lumber export trade of Sweden started on a big scale some 60 years ago, the importers have differentiated between the lumber products shipped from the various Swedish districts. The wood in the northern regions shows very pronounced qualities, such as solid texture, while in the southern districts of Sweden the wood is often more coarse-grained and pulpy. At present most of the virgin forests are cut out and the mills are more dependent upon obtaining their log supply from other sources. The differentiation now made is to a large extent, in regard to the product of different shippers; it is not based exclusively on shipping districts. The larger importers and agents, who generally are well posted on local conditions in Sweden, know the character of the shipments from most of the prominent exporters, and the prices paid for lumber may vary considerably for the products of different exporters in the same districts. Many shippers have obtained a good reputation among importers and consumers and by branding their products may be able to obtain a better price than their competitors although they may use the same raw material and the same manufacturing methods.

The best proof of this situation is that Swedish lumber exporters in several of the largest districts in Norrland take an important percentage of their log supply from northern Finland and, using the

same raw material as their Finnish competitors, obtain for their product several dollars more per 1,000 board feet. Logs are often taken from other districts in Sweden than from the section of the country where the mills have their forests. Sawn lumber also is barged from one sawmill district to another. For instance, lumber from Hernosand, which was sold at about 61 cents per 1,000 feet less than lumber from Sundsvall, farther south, was often barged to that port at a cost of about 13 cents per 1,000 feet, the Sundsvall exporters thereby making a profit of 48 cents per 1,000 feet.

It is evident that one can no longer make any accurate differentiation between the lumber products of the Swedish shipping districts; but the differentiation must be made in regard to the products of each individual exporter. If the mills have been able to maintain their good standing among the importers for shipping quality lumber, in spite of the fact that they are taking logs from other districts, they have done so through careful grading and efficient manufacturing and selling.

The following table shows the exports from different districts of Sweden in 1913 of pine and spruce planks, battens, and boards rough and planed (not including box shooks, staves, etc.):

Shipping districts.	Rough lumber.	Planed lumber.	Total rough and planed.
	M feet.	*M feet.*	*M feet.*
Haparanda, Lulea, Pitea, and Skelleftea	260,313	1,461	261,774
Umea and Ornskoldsvik	122,171	40,134	162,305
Hernosand	269,678	9,085	278,763
Sundsvall	256,552	81,004	337,556
Hudiksvall, Soderhamn, and Gevle	385,980	60,757	446,737
Stockholm-Malmo (including Gotland Island)	194,205	33,802	228,007
West-coast district	113,125	38,101	151,226
Districts bordering on Norway	42,610	20,575	63,185
Other districts	24,439	5,324	29,763
Total	1,669,073	290,243	1,959,316

UPPER-GULF REGION.

The upper-gulf district extends south from the Finnish border to a few miles north of the Angermann River and comprises the following districts: Haparanda, Lulea, Pitea, Skelleftea, Umea, and Ornskoldsvik. In the northern part of this region there were formerly several mills of medium size, but during the war a consolidation process took place, and one company now practically monopolizes the whole export trade in this part of the upper gulf. In the southern part of the upper-gulf district there are several very important mills, some are operated in connection with planing mills and pulp factories.

The pine from the upper gulf, particularly in the north, is of a reddish color and contains a larger percentage of heart than is found in the other districts of Sweden. The lumber is very knotty, however, and logs cut from overmature stands often contain many defects, so that it has been necessary in several instances to create an extra grade of cull lumber, usually termed "seventh grade." The pine from these regions is in great favor with the British, Egyptian, and other importers.

The spruce is not considered so satisfactory as the pine in the northernmost districts, but in the southern part of the upper gulf excellent spruce is found.

The lumber from the upper gulf may be classified as good construction lumber, although it is commonly considered not to have the same breaking strength as lumber taken from districts farther south, owing to the shorter fiber of the wood. This, however, is more theory than a scientifically proven fact and may be vigorously opposed by the lumber exporters in the upper gulf.

The lumber in the northernmost part is not suitable for planing purposes on account of its many knots. It is therefore sold only in one unsorted grade and two or three grades for cull stock.

The normal production in the upper gulf may be considered to be about 80 per cent pine and 20 per cent spruce, about 75 per cent of which would be graded as unsorted, 20 per cent fifth, and 5 per per cent sixth and seventh grade.

In the southern districts of the upper gulf the result of the grading would show a distinct improvement. More spruce lumber also is produced in these districts, and it is of excellent quality.

The lumber from the upper-gulf region is handicapped in regard to shipping facilities. The freight rates are usually higher than from other districts, and no direct steamship lines touch the ports, because this region consists almost exclusively of sawmill districts and it is difficult for shipowners to obtain cargoes for these ports. Particularly during the war, many mills found themselves with large quantities of lumber that they were unable to ship on account of the exorbitant freight rates. Moreover, the shipping season is short, as the ports are closed by ice in the autumn and the ice breaks up very late in the spring. For these reasons the prices are lower than for most of the other districts in Sweden, although the lumber itself is considered to be more satisfactory than that from many other districts.

Navigation opens in the northernmost parts of this region at the end of May and closes early in November; in the southernmost districts navigation is open at the beginning of May and closes in the beginning or middle of December.

HERNOSAND REGION.

Hernosand region, one of the most important in Sweden, comprises the land bordering the Angermann River and a narrow strip north and south of the river along the Gulf of Bothnia. Many mills are found on both sides of the river, which is navigable for about 70 miles, allowing steamers of any size to go up to the mills at this distance. The mills are usually smaller than in the other districts in Norrland. There is also a large pulp industry, affording good marketing conditions for the mill refuse. A number of planing mills are operated in connection with the sawmills.

The lumber from the Hernosand region seems to be rather uniform in regard to manufacture and grading, in spite of the fact that this territory has a large number of mills. The sawmills frequently cooperate in regard to the grading and sawing, etc., and shipments from the Hernosand district are considered in the general lumber

trade as typical Swedish standard products. When export prices are quoted, the Hernosand district is frequently made the basis, and the prices for the other districts are calculated by adding or subtracting the customary difference.

Formerly this region was almost exclusively a spruce-exporting district. The spruce lumber is of excellent quality and the wood is of an intense white color. The knots are small and firm and the wood is very dense. Lately, however, pine has been exported in a larger proportion than before, and the quality is good, although the pine from this section is not so well known as the spruce. The proportion of pine and spruce is about 55 per cent of spruce and 45 per cent of pine. In this district certain dimensions, especially of spruce, are classified into six grades, but the remainder is sorted into unsorted, fifth, and sixth grades.

The 3 by 9 inch spruce planks from Hernosand are much in demand in the French market, and this dimension is graded into six qualities. The grading of some of the representative Hernosand-district mills for 3 by 9 inch spruce planks shows the following result: First quality, 5 per cent; second quality, 10 per cent; third quality, 50 per cent; fourth quality, 35 per cent; The percentage of fifth and sixth grades may vary a great deal.

For the mills under discussion, the percentage of fifth and sixth grades combined amounted to 8 per cent of the total production of all grades. The result of the grading of the other dimensions of pine and spruce was 80 per cent unsorted, 9 per cent fifth, and 11 per cent sixth grade. The percentage of cull lumber is dependent largely upon the age of the timber stands.

One year a tract of overmature stands in a forest may be cut and the percentage of cull lumber consequently would be very large. The following year second-growth stands may be logged, and the percentage of cull in such a case may be very small. The virgin forests in this district are nearly all cut out now; only in the most remote mountain districts are there limited areas left.

It is commonly considered that the grading of the Hernosand district is somewhat less strict than that of the districts farther south in Norrland. Particularly is this true in regard to the amount of wane. However, the difference in grading is not very considerable between the Hernosand and the lower-gulf region and it can not be demonstrated satisfactorily in writing.

Navigation opens about the middle of April and closes at the end of December or the beginning of January.

LOWER-GULF REGION.

The lower-gulf region extends south from about 15 miles north of Sundsvall to about 60° latitude and constitutes by far the most important lumber export region in Sweden. It comprises the following shipping districts: Sundsvall, Hudiksvall, Soderhamn, and Gevle.

The largest sawmills in Sweden are located in this region, which also has an important planing-mill industry. Some mills located in the interior sections maintain yards at the ports. This region is also an important producer of pulp and paper and some mills operate their own railroads for transporting the lumber from the interior.

The quality of the output of the different standard mills in the lower-gulf region is considered uniform, although the southernmost districts generally have a larger percentage of clear lumber. Sundsvall and Hudiksvall, the two northernmost shipping districts in the lower-gulf region, are especially noted for their excellent spruce, while the quality of the pine of the southern shipping districts is better than that of the spruce in the same districts.

In the Sundsvall district only certain dimensions of pine and spruce are graded into six qualities; the remainder is graded as unsorted, fifth, and sixth. Hudiksvall and the districts south separate practically all dimensions of pine and some dimensions of spruce into six grades.

Sundsvall is particularly noted for the long average length of its production, and lumber from this district is especially in demand by the British colonial markets, such as South Africa and Australia. The other districts have specialized in high-grade stock for joinery and the better class of construction material.

The following figures show the percentages of pine and spruce in the different grades for the Sundsvall shipping district: Unsorted, 88 per cent; fifth grade, 7 per cent; sixth grade, 5 per cent. For pine planks the grading is about as follows: First grade, 3 per cent; second grade, 7 per cent; third grade, 40 per cent; fourth grade, 35 per cent; fifth and sixth grades, 15 per cent. The percentages of spruce planks in the different grades is as follows: First grade, 2 per cent; second grade, 16 per cent; third grade, 42 per cent; fourth grade, 14 per cent; fifth and sixth grades, 26 per cent. The percentages for the fifth and sixth grades vary a good deal and can not be considered as average.

Spruce lumber from shipping points south of Sundsvall is graded about as follows: Unsorted, 85 per cent; fifth and sixth grades, 15 per cent. Some dimensions of spruce may be separated into six different grades in the same way as pine, but the grades commonly used for spruce lumber are unsorted, fifth, and sixth.

The table following shows the average percentage of different kinds of pine lumber in each of the first four grades in some of the largest mills of southern Norrland. For grades V and VI no average figure can be given, but in most cases the proportion of V and VI seems to be about 15 to 20 per cent of the total production. The percentages in the table are calculated on the basis of the total quantity in the first four grades.

Kinds of lumber.	I grade.	II grade.	III grade.	IV grade.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Planks	2	15	42	41
Battens	4	18	38	40
Boards	7	14	32	47
Narrow boards	6	13	36	45

Scantlings are usually divided only into unsorted, fifth, and sixth grades.

The logs in the southern part of the lower-gulf region give a larger percentage of the upper grades than those found in many other parts of Sweden. Although the lumber exporters in other parts of Sweden, who are able to ship the year round, may obtain better prices during the winter months than are obtained for lumber from the lower gulf,

this is no indication of better quality but is due to the ability to furnish lumber when the lower-gulf shipping ports are closed by ice.

Navigation opens about the middle of April and closes at the end of December or the beginning of January.

STOCKHOLM-MALMO REGION.

The Stockholm-Malmo region comprises all the shipping districts south of 60° north latitude and takes in the southeastern coast and the southern coast up to and including the city of Malmo. A large number of small mills are scattered in this territory and, outside of a few larger mills, there are no standard operations. While excellent timber is found in the northern parts of this region, north and south of Stockholm, the other parts of southeastern and southern Sweden are not known for good quality. With the exception mentioned, the lumber shipped from this district probably represents the poorest quality in Sweden.

The manufacturing of the lumber also is usually defective, and these shipments can not be considered as representative of Swedish lumber for export. The lumber is often carelessly cut, usually on circular saws, which gives it a rough surface.

Owing to the poor floating facilities in this region, the logs have not generally been in contact with water, and the wood is often very hard on this account, particularly timber originating in the highlands of Smaland. Blue lumber constitutes a large percentage of these shipments, owing to defective methods of seasoning, and in many ports lumber is shipped that has not been edged.

The lumber is usually graded into unsorted, fifth, and sixth grades, but, as the lumber export business is mainly in the hands of export merchants, there are no established grading rules. A large part of the output is sold locally or to the box factories and planing mills, especially on the west coast of Sweden. Most of the lumber shipped from southeastern Sweden is about 14 feet to 15 feet in length. Pine lumber is the predominating factor in the export trade.

On the Island of Gotland similar conditions prevail. The quality of the lumber shipped is rather good and it is of solid texture, although very knotty. The wood is very hard, owing to the fact that it has not been floated. For a long time Brazil was a favorable market, but now the bulk of the lumber shipped from this island goes to Germany.

Although the shipments from the Stockholm-Malmo region usually are defective, some mills produce very satisfactory lumber. Especially in the Norrkoping district, several first-class mills may be found and larger dimensions may often be obtained here than from other parts of Sweden, some of the logs being cut on State forest land.

The prices obtained for lumber from southeastern Sweden under normal conditions, during the season when all shipping districts in Sweden are open to navigation, are considerably below the prices obtained in other districts. Exceptions must be made for standard shipments from this district.

During late years navigation has usually been open the year round, although some ports may be closed for a few weeks.

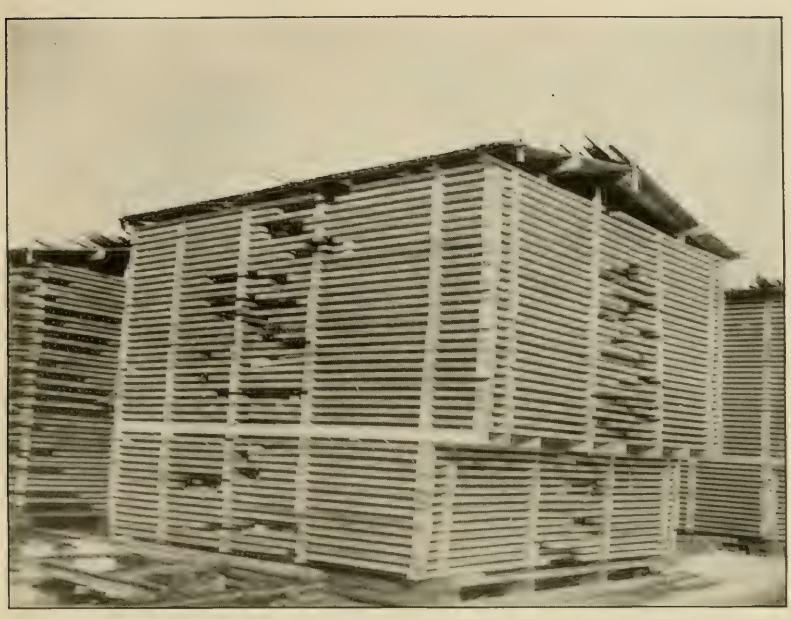


FIG. 87.—ANOTHER METHOD OF PILING.

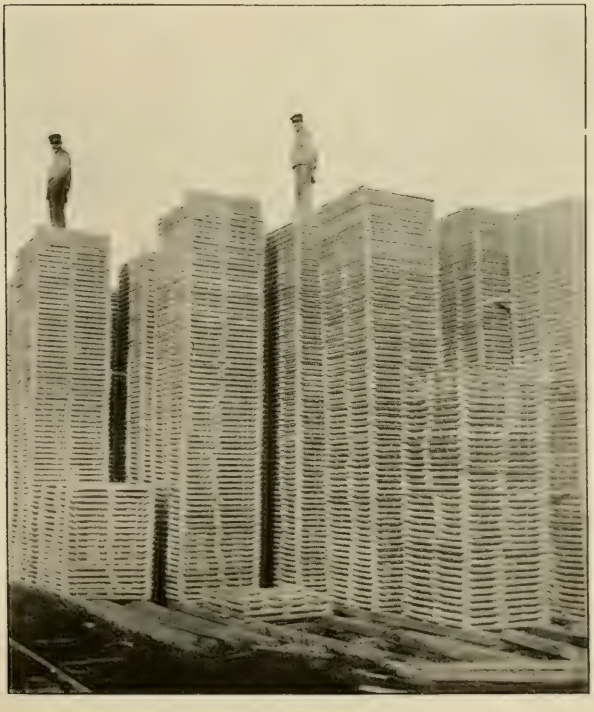


FIG. 88.—PILING OF STAVES.

FIG. 89.—PINE STAVES READY FOR SHIPMENT.

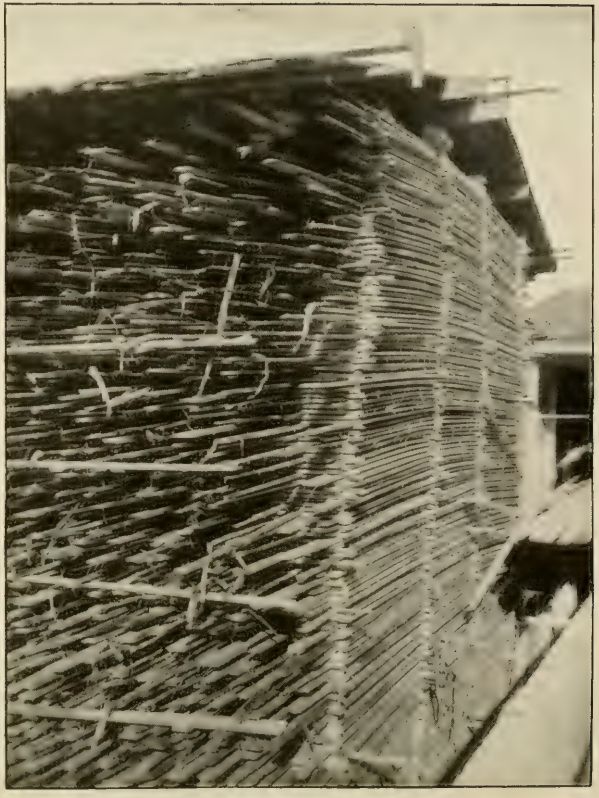


FIG. 90.—PILE CONTAINING "SCHAALBRETTER" USED FOR PACKING CASES FOR GLASSWARE IN BELGIUM.

WEST-COAST REGION.

The west-coast region extends from Malmo up to the Norwegian boundary on the west coast. In this region Goteborg is practically the only port of any importance. From the smaller ports is shipped lumber from the interior districts of southern Sweden, similar in character to that from the east coast, while Goteborg shipments represent mainly the lumber products of the districts of Vermland, with some from Dalecarlia. Some of this lumber is shipped direct from mills on Lake Wenner through the canal. Goteborg shipments are considered among the best in Sweden and the export lumber business is in the hands of old, well-established firms.

The character of the lumber shipped via Goteborg is similar to that shipped from the south Norrland ports. The great advantage of this port is that it is open the year round, and the prices obtained, especially during the winter months, are considerably higher than those obtained from the Norrland ports during the summer months.

For a good production in Vermland, the proportion of the first four grades of pine and spruce would be about as follows: First grade, 5 per cent; second grade, 20 per cent; third grade, 55 per cent; fourth grade, 20 per cent. Of the fifth and sixth grades, the quantity is about 10 to 15 per cent of the total production.

Goteborg is in an especially advantageous position in regard to shipping because many direct liners run from this port to the principal European countries and also to the principal markets outside of Europe. This is also the best port on the west coast.

This district is one of the main centers for exports of joinery, planed stock, and box shooks.

DETAILED CONSIDERATION OF PRINCIPAL MARKETS.[1]

UNITED KINGDOM.

The United Kingdom is the most important of all markets for Swedish lumber. Almost any dimension of pine and spruce, both rough and dressed, finds a market there. Pine is generally preferred in England and Ireland, while more spruce is shipped to Scotland.

The British market is very conservative and often specifies wide stock of lumber when narrower dimensions would serve the same purpose. Shipments from the northern Provinces of Norrland are especially in favor in the United Kingdom on account of the reddish color. British shipyards and other plants sometimes call for heart specifications, but the demand can not be satisfied from Sweden in spite of the high prices offered.

"Torrac" of pine and spruce, or lumber sawn from dead trees with only the heartwood left, the sapwood having decayed, is shipped in considerable quantities and used extensively for construction purposes, especially when the lumber is to come into contact with water. This torrac lumber, however, is to be considered low-grade material.

It is almost impossible to give a detailed statement in regard to the different dimensions required by this market, as nearly any dimension can be sold in the United Kingdom. The following

[1] Various tables in the appendix show the quantities of lumber shipped to each country. The description of the requirements of the principal markets in this section is based on pre-war conditions.

dimensions, however, are usually called for, in both pine and spruce: 3 by 11, 9, 7, 6, 4½, and 4 inches; 2½ by 7 and 6 inches; and 2 by 7, 6, 5, 4½, 4, and 3 inches. Pine and spruce boards in various widths and in thicknesses of 1½, 1¼, and 1 inch are also in demand. Scotland demands principally spruce lumber, usually in the following dimensions: 3 by 9, 8, and 7 inches; 2½ by 8, 6½, and 6 inches; and 2 by 7, 6, 5½, 5, 4½, and 4 inches. Ireland often specifies wide boards, up to 11 inches.

The United Kingdom may be termed a market for planks. Battens and boards are taken in comparatively small quantities. It is the principal market for Swedish planed stock, taking about 50 per cent of the total Swedish output for export of this kind of lumber. The planed boards are taken in almost any sizes. This market also requires 7-inch weatherboards, which are not exported elsewhere except to Australia. To the United Kingdom is shipped more than 50 per cent of Sweden's output for export of staves, box shooks, and split wood. It also is one of the most important markets for logs and timber and takes practically the entire quantities exported from Sweden of pit props and ties.

The following are typical specifications for the London and the Scottish markets:

LONDON.

Pine, unsorted:	M feet.
4 by 8 inches	10
4 by 7 inches	10
3 by 9 inches	99
3 by 8 inches	50
3 by 7 inches	30
3 by 5 inches	10
2½ by 8 inches	10
2½ by 7 inches	198
2½ by 5 inches	10
2 by 11 inches	2
2 by 9 inches	20
2 by 8 inches	20
2 by 6 inches	40
2 by 5 inches	50
2 by 4½ inches	228
2 by 4 inches	139
1 by 7 inches	99
⅝ by 5½ inches	20
⅝ by 5 inches	50
Total	1,095

SCOTLAND.

Pine, unsorted:	M feet.
3 by 11 inches	20
3 by 9 inches	40
3 by 7 inches	20
2½ by 7 inches	50
2½ by 6½ inches	30
2½ by 6 inches	20
2 by 6 inches	20
2 by 4 inches	30
Spruce, unsorted:	
3 by 9 inches	50
3 by 7 inches	30
2½ by 7 inches	149
2½ by 6½ inches	198
2 by 7 inches	20
2½ by 6 inches	198
2 by 6 inches	154
2 by 4 inches	50
Total	1,079

FRANCE.

Next to the British the French market is normally the most important for Swedish lumber and it was increasing in importance during the years before the war. Both pine and spruce are taken, and spruce from the Hernosand and Sundsvall districts is much in demand.

France takes important quantities of planks and battens and narrow boards, but only limited quantities of wide boards. The lumber is usually trimmed to metric feet. During the last 25 years the heavy duty imposed upon planed lumber imported into France has prevented the Swedish exportation of such stock to this market.

The lumber taken from Sweden represents a better quality than that imported from Finland. Swedish lumber is used in France mainly for joinery and better-grade construction. The competition from Russian ports, particularly from Archangel, was very keen before the war, but Swedish shippers had a considerable advantage in lower freight rates.

Some of the principal dimensions taken in northern France and in southern France are as follows:

Northern France.	Southern France.
Spruce: 3 by 9 inches.	Pine[a]:
Pine:	3 by 8 inches.
2½ by 7 inches.	3 by 7 inches.
2½ by 6½ inches.	2 by 8 inches.
2½ by 6 inches.	1½ by 4½ inches.
Pine and spruce:	1½ by 4 inches.
1½ by 4½ inches.	1¼ by 4½ inches.
1¼ by 4½ inches.	1¼ by 4 inches.
1 by 4½ inches.	
1 by 4 inches.	

[a] There is also a small amount of spruce in the same dimensions.

Three by nine inch spruce planks are in great demand in France and are graded in a special way. Both pine and spruce boards are taken unsorted. The French market also takes some staves, box shooks, and small timber.

A typical specification for France is as follows:

	M feet.
Spruce:	
First grade—3 by 9 inches	30
Second grade—3 by 9 inches	99
Third grade—3 by 9 inches	198
Fourth grade—3 by 9 inches	99
Fifth grade—2½ by 7 inches	594
Pine:	
Unsorted—	
2½ by 7 inches	594
1¼ by 4½ inches	40
1½ by 4 inches	10
1¼ by 9 inches	50
1 by 9 inches	50
Pine—Continued.	
Unsorted—	M feet.
1¼ by 4½ inches	30
1 by 5 inches	99
1 by 4½ inches	238
1 by 4 inches	198
3 by 9 inches	198
2½ by 7 inches	198
Fifth grade—	
2½ by 7 inches	594
	3,319

GERMANY.

Germany is close to several of the most important producing countries in Europe, and this fact, together with its own extensive forest resources, makes it possible for German lumber dealers to make a good selection of lumber from the most suitable sources.

In the German market Swedish lumber, therefore, meets keen competition with native German, Finnish, Russian, and Austrian lumber. The market for Swedish lumber is thus somewhat limited and is not nearly so important as the French and British markets. The Danish market, though it serves a population of only about 3,000,000, is nearly as important for Swedish lumber as the German market. The demand for Swedish lumber in Germany is not so stable as in the United Kingdom and France.

Germany takes principally spruce lumber, mainly battens and narrow boards, together with very small quantities of planks. The

Rhine district is one of the best markets for Swedish spruce, but the Rhine importers do not generally buy the spruce north of the district of Sundsvall. The lumber is usually imported via Dutch ports and taken on barges up the Rhine. As the Netherlands figure in Swedish statistics as the importer of this stock, it is not possible to find out the exact quantities shipped in this way to Germany. The dimensions most in demand (chiefly spruce lumber) are 2½ by 7, 6, 5½, and 5 inches and 2 by 7, 6, 5½, and 5 inches.

The Bremen market calls for large quantities of 2½ by 6 inch spruce, part of which is shipped to Saxony. This particular dimension is consumed mainly by the German planing-mill industry in resawing the battens into boards, whereby a saving in raw material may be effected. Spruce boards are taken chiefly in the following dimensions: 1 by 5, 1¼ by 5, 1¼ by 5½, 1¼ by 6, and 1¼ by 7 inches, and pine boards in sizes from 4 to 9 inches wide.

This pine stock is taken chiefly from the lower-gulf district and usually in the upper grades. Unsorted boards and narrow boards are generally bought from the other shipping districts in Norrland. Important quantities of lumber are also taken from southern Sweden. In certain markets in northern Germany, fifth-quality boards in various widths are taken. A specialty in the German market is the so-called "schaalbretter," which are waney sap boards used for packing material and boxes. The thicknesses are usually five-eighths and three-quarters of an inch and the widths 3 to 7 inches. The schaalbretter usually contain 20 to 30 per cent of short lengths, 6 to 8 feet, and the only requirement in regard to wane is that the saw must touch all four sides of the piece.

The German importers frequently specify odd dimensions, such as seven-eighths, nine-eighths, 2¾ inch thicknesses, where they formerly ordered 1 to 1¼ inches, 3 inches, etc. Undoubtedly in many cases these dimensions are sold as holding a larger measure than they actually do. The Swedes do not look with satisfaction upon having their lumber sold in this way, and some mills even refuse to brand such stock. In most of these cases the Germans may use the odd dimensions for planing purposes, and by using modern planers, often of Norwegian or Swedish construction, they may be able to dress these rough dimensions down to the required sizes, where formerly greater thicknesses would be required. Such odd dimensions, however, always command extra prices.

Planed lumber does not find a good market in Germany, partly on account of the tariff and partly because the German planing-mill industry is highly developed.

Germany imports some Swedish staves and box shooks, and considerable quantities of small timber and telegraph and telephone poles.

DENMARK.

Denmark affords an important market for Swedish lumber. The Danish market does not require such long lengths of lumber as, for instance, British colonial markets. The Danish market is supplied mainly by the mills in southern Sweden, where short stock predominates. The principal requirement in Denmark is to receive the lumber in a bright condition, and the Swedish shippers are particularly careful not to ship blue lumber to this market, as heavy claims

would be certain to ensue. Pine lumber is generally preferred; of the total quantities of lumber exported to Denmark from Sweden, less than one-third is spruce lumber. Denmark is decidedly a market for boards, which constitute about 90 per cent of the lumber imported from Sweden.

The principal dimensions taken by the Danish market, are as follows: 7 by 1½, 1¼, 1, and ¾ inch; 6 by 1½, 1¼, 1, and ¾ inch; and 5 by 1½, 1¼, 1, and ¾ inch; 1½ by 5 inches and 1¼ by 6 inches are in particular demand, and it is sometimes difficult in Sweden to supply the demand for this stock. The boards are often taken of the upper grades, and the prices paid for this stock are very satisfactory. Limited quantities of pine planks and battens, particularly 2½ by 5 inches, 2¼ by 5 inches, and 2 by 5 inches, are called for.

Of cull and low-grade lumber the following dimensions are usually shipped: 1 by 5½, 5, 4½, and 4 inches; ¾ by 5½, 5, 4½, and 4 inches; and ⅝ by 5½, 5, 4½, and 4 inches. Schaalbretter are also in demand in this market.

Next to the United Kingdom, Denmark is the largest market for Swedish planed lumber, which is usually shipped in the unsorted grade. The following sizes are the most in demand: 1¼ by 5, 6, and 7 inches and 1 by 5, 6, and 7 inches. Pine and spruce are taken in about equal quantities.

Denmark also imports considerable quantities of split wood and staves, timber, props, and ties, and large quantities of small timber and telegraph and telephone poles.

The following specification is an example of a Danish shipment calling for a large number of items and very small quantities of each:

	M feet.
2½ by 12 inch first and second grade pine	2
2½ by 11 inch first and second grade pine	2
2½ by 10 inch first and second grade pine	2
2½ by 9 inch first and second grade pine	2
2 by 12 inch first and second grade pine	2
2 by 11 inch first and second grade pine	2
2 by 10 inch first and second grade pine	4
2 by 8 inch second grade pine	10
2 by 7 inch second grade pine	20
1½ by 8 inch second grade pine	10
1½ by 7 inch second grade pine	10
1¼ by 12 inch first and second grade pine	2
1¼ by 11 inch first and second grade pine	2
1¼ by 10 inch first and second grade pine	2
1¼ by 9 inch first and second grade pine	4
1¼ by 8 inch third grade pine	10
1 by 9 inch third grade pine	10
1¼ by 7 inch first grade pine	10
1¼ by 7 inch second grade pine	10
1¼ by 6 inch first grade pine	10
1¼ by 6 inch second grade pine	10
1 by 7 inch first grade pine	10
1 by 7 inch second grade pine	10
1 by 6 inch third grade pine	30
1¼ by 8 inch unsorted grade	20
	206

NETHERLANDS.

For hundreds of years the Netherlands has been one of the principal markets for Swedish lumber. Spruce is most in demand, partly for consumption in the country itself and partly for reexport to Ger-

many. Shipments of spruce lumber constitute about 80 to 85 per cent of the entire quantity exported to this market, and lumber of all thicknesses up to 3 inches, and in widths from 5 inches up to and including 11 inches, is in demand. This market takes mainly battens and boards.

Of the various dimensions of battens and boards of pine and spruce, the following are most in demand: 3 by 5, 6, 6½, 7, and 8 inches; 2½ by 5, 6, 6½, 7, and 8 inches; 2 by 5, 6, 6½, 7, and 8 inches; 1½ by 5, 6, 6½, 7, and 8 inches; 1¼ by 5, 6, 6½, 7, and 8 inches; 1 by 5, 6, 6½, 7, and 8 inches.

About 30 per cent of the total shipments to the Netherlands are made up of planed lumber, almost all spruce, in the usual standard sizes, such as 1¼, 1, seven-eighths, and three-fourths inch thicknesses, and chiefly 5 and 8 inch widths. Some widths of 7, 6½, and 6 inches also are taken. Either the planed lumber is shipped in the unsorted grade or the unsorted grade may be sorted into, for instance, two grades (first and second), with 50 per cent of the total quantity in each grade, according to special instructions in each case.

During late years, the Netherlands has come into the market for several odd dimensions of rough lumber, such as 1¾, 2¾, 3¾, 4¾, and 5¾ inches, etc. This stock may be used for the same purposes as in Germany. Both German and Dutch importers are known to be very technical regarding claims; they expect the lumber to have the exact dimensions specified.

The Netherlands also imports some quantities of split wood, staves, and similar stock and takes considerable quantities of small timber.

BELGIUM.

Before the war most of Belgium's imports consisted of narrow boards of pine and spruce, chiefly from the lower-gulf district. Pine lumber is preferred. Planed lumber is not imported and only limited quantities of battens and planks, as Swedish lumber was generally considered of too high quality for the Belgian requirements. The industries in that country used large quantities of low-grade stock for packing cases, and cheap lumber for this purpose was taken from Russia and Finland. Schaalbretter of the same specification as those taken by Germany, and discolored and cull lumber were also in demand. The boards taken from Sweden were generally in thicknesses of 1 inch and five-eighths of an inch, and in widths of 4, 4½, and 5 inches. The lumber for Belgium is trimmed to metric feet. Considerable quantities of staves and box shooks are imported.

Controversies between the shippers and the Belgian importers were frequent before the war, resulting from claims in regard to quality made by the importers. The prices obtained in this market for Swedish lumber were often less satisfactory than those obtained in other markets in Europe.

SPAIN AND CANARY ISLANDS.

While the north Spanish ports take mostly pine, the Mediterranean ports call chiefly for spruce. It is of main importance to ship the lumber absolutely bright to this market, as it is not painted when used for flooring, and blue lumber is practically worthless for this purpose.

Formerly in southern Spain lengths of 14 feet were chiefly in demand. This custom, however, is gradually disappearing, and the tendency is to take the usual lengths produced by the Swedish exporters. The specifications for this market vary but slightly from one year to another. Among the principal standard dimensions are 4 by 9 inches, 3 by 11 inches, 3 by 9 inches, 3 by 8 inches, 3 by 7 inches, 2½ by 7 inches, 2½ by 4 inches, 2 by 9 inches, 2 by 8 inches, and 2 by 4 inches. Four, six, and eight inch boards, in thicknesses of 1½, 1¼, and 1 inch are generally called for, especially in northern Spain. For 1 by 4 inch pine and spruce the Swedish exporters can hardly satisfy the demand. Many odd dimensions are often called for.

Spain does not import planed lumber on account of the heavy duty imposed on such stock. It is mainly a plank market. Limited quantities of small timber are also imported. The Canary Islands, which belong to Spain, afford a good market for sawn box shooks, particularly those from the western coast of Sweden.

NORWAY.

The barren west coastal districts of Norway take considerable quantities of lumber from Sweden. Large quantities of Swedish lumber are also exported to Norway for reexportation, either rough or manufactured into planing-mill products, box shooks, etc. Most of the Swedish lumber is taken in battens and planks and small quantities of boards.

Cull lumber, especially in the 3 by 9 inch dimension, for construction purposes, has been extensively called for during recent years. Norway also imports large quantities of planed lumber, part of which is destined for reexportation. The reexportation from Norway of Swedish lumber will be treated in the Norwegian report.

Norway imports from Sweden considerable quantities of staves, box shooks, split wood, logs, small timber, props, and pulp wood, part of which is for reexportation.

OTHER EUROPEAN MARKETS.

To Portugal almost nothing but pine battens and planks from 8 inches and up in width are exported. A specialty in the Portuguese market is 10-inch planks, which can be sold in very few markets besides Portugal and the United Kingdom.

In Italy the Swedish lumber comes into keen competition with lumber from Austria and other southeastern European countries. The market is not important and is limited chiefly to pine planks, usually 3 by 9 inches. There is also a limited call for pine battens 2 by 4 inches and 2 by 5 inches, and pine boards 1¾ by 6 inches, ¾ by 6 inches, 1¼ by 9 inches, 1½ by 4½ inches, and 1½ by 6 inches. This market also takes small quantities of timber.

Greece is a rather unimportant market. It takes limited quantities of pine boards and battens of 1 by 5 and 6 inches, and 2 by 5 and 6 inches, besides very small quantities of planed narrow pine boards and small timber.

Turkey takes some quantities of planed pine lumber of 5 and 5½ inch stock, small quantities of rough lumber, and small timber. This market grew rapidly with the establishment of direct steamship lines.

Les marques

Αἱ μάρκαι

EEE IAE A+E

EE

στιγματος couronne

KKK XXX

de Bois de Suède

τῆς Σουηδικῆς Ξυλείας

sont universellement reconnues comme les mieux appropriées pour les travaux de construction

είναι παγκοσμίως ἀνεγνωρισμέναι ὡς αἱ καταλληλότεραι διὰ οἰκοδομησίμους ἐργασίας καὶ ἐπιπλοποιΐαν, λόγῳ ποιότητος ξυλείας δεδοκιμασμένης πρὸ ἑκατονταετηρίδος διὰ τὸ διατηρήσιμον αὐτῆς (comme c'est par suite de la situation privilégiée que possèdent les Forêts du nord d'où se tirent nos Bois durable) αἰτία τῆς φυσικῆς προνομιούχου θέσεως τῶν Δασῶν τοῦ Βορρᾶ ἐξ ὧν ὑλοτομεῖ τὴν ξυλείαν του ὁ Οἶκος

J. A. Enhörnings

Trävaru Aktiebolag

in Sundsvall

Prix-courants de Bois de Suède

ΤΙΜΟΛΟΓΙΑ ΣΟΥΗΔΙΚΗΣ ΞΥΛΕΙΑΣ

de l'année 1912

ΕΤΟΥΣ 1912

en vigueur chez les marchands de bois d'Athènes, X

ΠΑΡΑ ΤΟΙΣ ΞΥΛΕΜΠΟΡΟΙΣ ΑΘΗΝΩΝ - ΠΕΙΡΑΙΩΣ du Pirée

Διαστάσεις εἰς ἑκατοστά en c/m.	Ἀθηνῶν Athènes		Πειραιῶς Pirée	
	ΜΑΡΚΑ marque	ΜΑΡΚΑ marque	ΜΑΡΚΑ marque	ΜΑΡΚΑ marque
	EEE	IAE	EEE	IAE
7 ½ × 23	2.75	2.50	2.70	2.45
5 × 23	2.20	2.00	2.15	1.95
4 × 23	1.70	1.50	1.65	1.45
3 ¼ × 23	1.50	1.30	1.50	1.30
2 ½ × 23	1.20	1.00	1.17	0.97
5 × 15	1.10	0.95	1.07	0.92
4 × 15	0.80	0.70	0.78	0.68
3 ¼ × 15	0.70	0.60	0.68	0.58
2 ½ × 15	0.55	0.48	0.53	0.46
5 × 12 ½	0.85	0.75	0.83	0.73
4 × 12 ½	0.70	0.60	0.68	0.58
3 ¼ × 12 ½	0.52	0.46	0.51	0.45
2 ½ × 12 ½	0.42	0.37	0.41	0.36
	A + E		A + E	
10 × 12 ½	1.60		1.55	
9 × 12 ½	1.40		1.35	
7 ½ × 12 ½	1.20		1.15	
7 ½ × 15	1.45		1.40	

Prix sous exemptés en drachmes et par m. courant

Τιμαὶ ἄνευ ἐκπτώσεως εἰς δραχμὰς κατὰ μέτρον τρέχον.

Παράδοσις εἰς τὰ Ξυλεμπορικὰ Κ/τα.

Livraison lieu magasins.

La Maison Suédoise

Ὁ Οἶκος Σουηδίας

Enhörnings

ENXEPNINΣ

propriétaire de scieries importantes et

ἰδιοκτήτης μεγάλων Πριονιστηρίων εἰς Kubikenborg καὶ Heffners πλησίον τοῦ Σούντσβαλλ ἐξάγει ἐτησίως περίπου 30,000 στάνταρς ἢ μέτρα Κυβ. 140,000 ξυλείαν pour constructions & meubles πριονιστὴν δι' οἰκοδομὰς καὶ part de transettes et elle ἐπιπλοποιΐαν ἐκτὸς τῆς πελεστ intéressée au parfum κητῆς ξυλείας (τραβεττῶν) καὶ universelle employée μιμοσεῖνε ἑταῖρος εἰς τὰ κάτωθι ἀτrement pour les expéditions μόπλοια ἀποκλειστικῶς διὰ τὰς de son bois, à ses divers ἀποστολὰς τῆς ξυλείας του εἰς clients :

τοὺς πελάτας του :

4/s. Orlando. tons

Ἀτμ. «Ὀρλάνδο» 2250 τόν

» «Ὀθέλλος» 2250 »

» «Ὄγιο» 1600 »

» «Βαλκύριαν» 1500 »

FIG. 91.—Swedish price list, in Greek, showing brands.

Gibraltar, Iceland, and the Faroe Islands take small quantities of lumber, mainly pine stock, and limited shipments of small timber have been made to Bulgaria.

ASIA.

To Asia Sweden has exported only small quantities of lumber. Persia, British India, and the Dutch East Indies have imported some quantities of planed and sawn box shooks from the west coast of Sweden. Asiatic Turkey (included under Turkey in the statistics in the appendix) is practically the only Asiatic market of any importance, importing box shooks, planks, battens, and planed and rough boards of pine, besides small timber.

NORTH AFRICA.

Algeria, Tunis, and Morocco have increased very rapidly in importance during the last 10 years. They take mostly pine in such dimensions as 3 by 9 inches, 2 by 4½ inches, 1½ by 6 inches, and 1½ by 4½ inches rough. Of planed lumber, pine is preferred, and is usually taken in the following dimensions: 1¼ by 4½ inches, 1¼ by 5 inches, 1 by 4½ inches, and 1 by 5 inches.

The demand for Swedish lumber in Egypt has varied a great deal from one year to another, as this market to great extent is supplied from Austria and Rumania.

Pine lumber is most in demand and is imported in sizes such as 4 by 9, 3 by 9, 2 by 9, 2 by 8, 2½ by 7, 2 by 6, 2 by 4½, 2 by 4, 1½ by 8, and 1½ by 4½ inches. Small quantities of narrow planed pine boards are also taken. The exportation from Sweden to Egypt of small square timber has been a large item. As the small timbers are often cut from young stands, the exportation of this stock has been vigorously opposed by advocators of rational forestry in Sweden, and the exportation of small square timber to Egypt declined about 65 per cent during the last 10 years before the war. It will very likely be materially reduced in the years to come on account of the stringent laws concerning the cutting of immature stands in Sweden.

The following is a typical specification for Egypt, consisting entirely of unsorted-grade pine:

	M feet.		M feet.
4 by 9 inches	99	1½ by 8 inches	79
3 by 9 inches	297	1¼ by 8 inches	79
2½ by 9 inches	198	1 by 8 inches	79
2 by 9 inches	495	2½ by 7 inches	158
1½ by 9 inches	396	2 by 6 inches	495
1¼ by 9 inches	297	2 by 4½ inches	396
1 by 9 inches	198	2 by 4 inches	59
¾ by 9 inches	40	1½ by 4½ inches	149
½ by 9 inches	20		
2 by 8 inches	149		3,683

BRITISH SOUTH AFRICA.

Among the markets outside of Europe, British South Africa is the most important. While one after the other of the European countries have stopped the importation of planed lumber by imposing heavy customs duties on such stock, the Swedish lumber exporters

have succeeded in maintaining their planing mill industry by finding new markets, particularly in the British colonies.

Of rough lumber, pine planks 3 by 9 inches, in third, fourth, and fifth grades are mostly shipped. During late years, however, the South African importers have discovered that scantlings and battens can be obtained more cheaply by ordering these dimensions from Sweden than by resawing them in South Africa from imported planks. Therefore, dimensions such as 2 by 3, 3 by 3, 3 by 4, 3 by 4½, 3 by 5, and 3 by 6 inches are now called for in this market, besides small quantities of 2 by 6 and 2 by 5 inches. The South African market takes pine lumber almost exclusively.

In planed lumber (pine and some spruce) the specifications usually call for 1¼, 1, and ⅝ inch by 6½ inches; 5 by 1¼ and 4½ by 1¼ inch pine is in demand, besides a few other sizes. The planed lumber is graded into "colonial first," which is a mixture of first and second grades of planed stock, and "colonial third." About 30 per cent of the total imports to this market consist of planed stock.

The South African market demands long lengths. Lumber less than 10 feet long is seldom shipped, and specifications often call for 16 feet and longer, usually specifying a certain quantity of each dimension in lengths of 20 feet and up. Limited quantities of box shooks are also imported.

The lumber shipped to South Africa and other African countries must be specially well seasoned. For this extra care, the Swedish lumber exporters obtain about $2.50 to $3 per 1,000 feet above the prices usually charged for the same dimensions in European markets.

A typical railroad specification for South Africa is as follows.:

	M feet.
4 by 11 inch pine, third grade	6
3 by 11 inch pine, third grade	67
4 by 9 inch pine, third grade	28
3 by 9 inch pine, second grade	1,172
3 by 9 inch pine, third grade	1,841
1¼ by 6½ inch, colonial first, tongued and grooved	149
1 by 6½ inch, colonial first, tongued and grooved	556
⅝ by 6½ inch, colonial first	85
⅝ by 6½ inch, tongued, grooved, and center beaded	147
Total	4,051

OTHER MARKETS OF AFRICA.

Portuguese East Africa and French West Africa take both planed and rough lumber, mostly pine, in about the same sizes as British South Africa.

Other sections of Africa occasionally take small quantities of Swedish lumber, but they are not considered established markets for this product, as the exportation is dependent upon casual chances of shipping space, etc., and not on the result of a systematic exploitation of these fields by Swedish lumber exporters or their agents.

AUSTRALIA.

Australia is a very important market for Swedish lumber, both planed and rough, and the Australian business increased materially during the last decade before the war in spite of the distance of about 13,000 miles from Sweden. The specifications are similar to those of South Africa, but Australia takes mostly planed lumber. In planed lumber, spruce is chiefly in demand, while the rough lumber

consists almost exclusively of pine stock. The rough lumber is usually imported in the following sizes: 4 by 9, 3 by 11, 3 by 9, 2½ by 7, and 2½ by 6½ inches. While South Africa generally takes third and lower grades of rough lumber, Australia prefers first, second, and third grades, shipped in large quantities. Of planed lumber the following sizes are shipped in the largest quantities: 6 and 6½ inches in width and one-half, five-eighths, three-fourths, 1, 1¼, and 1½ inches in thickness. The planed lumber is classified into colonial first and colonial third grades. Australia also takes 7-inch weather boards, which are shipped in the unsorted grade, and considerable quantities of sawn box shooks.

THE AMERICAS.

Although South America is not an important market for Swedish lumber, the trade has been steadily growing with the direct steamship lines established a few years before the war. Brazil formerly afforded a good market for Swedish lumber, to a large extent exported from the Island of Gotland, where 3 by 9 inch lumber, 14 feet long, was the principal dimension shipped. At present most of the lumber for South America is shipped from the west coast of Sweden. Brazil takes chiefly pine and spruce planks.

The Argentine market has been developed recently and the principal dimensions shipped to this market from Sweden are 2 by 6, 2 by 3, 1 by 6, and 1 by 3 inch spruce, and also limited quantities of planed lumber in widths from 6 to 8½ inches. Argentina also takes limited quantities of sawn and planed box shooks.

Uruguay and a few smaller markets have at times imported limited quantities of Swedish lumber. The Swedish exporters managed to extend their market even to Chile, but so far only small quantities of planed boards have been shipped on the regular liners.

North America and Central America do not figure as importers of Swedish lumber.

COMPETING LUMBER-EXPORTING COUNTRIES.

RUSSIA.

There has in years past been considerable competition between the shippers in the various north European lumber countries. Russia particularly has offered keen competition because the quantities of lumber exported from that country were much larger than the quantities exported from Sweden, and both raw material and labor have been very cheap in Russia. The Russian lumber from certain sections is also considered superior in quality to the average Swedish stock. The Swedish lumber exporters, however, do not fear competition from exporters in other countries as long as such competition is fair and the export policy followed is systematic. Russian shippers have often dumped their stocks on foreign markets at very low prices. Many Russian shippers before the war had not sufficient capital to enable them to hold their stock when the markets were unable to absorb large quantities of lumber, and consignments from Russia to European markets have constituted a large percentage of the quantities exported from that country. As a whole, the Russian ex-

porters are not on a par with the Swedish exporters in regard to export methods, and it has often been difficult, therefore, for the Swedish exporters to have any clear idea of the policy that would be followed during the selling season by the Russian shippers in regard to prices, shipments, etc.

The Russian exporters have usually been able to furnish wider stock and longer lengths than the Swedish exporters, but have often failed to take advantage of these facts. The following stock list, representative for the better class of shipments from the Archangel district on the White Sea, shows these shippers' ability to furnish wide stock:

	M feet.		M feet.
3 by 11 inches	6,930	1 by 7 inches	1,782
3 by 9 inches	5,940	¾ by 7 inches	693
1½ by 11 inches	2,376	¾ by 6 inches	693
1½ by 10 inches	1,584	¾ by 5 inches	693
1 by 11 inches	1,287	½ by 3–11 inches	1,287
1 by 9 inches	2,277		
1 by 8 inches	1,980	Total	27,522

The following schedule covering sales made in 1914 to the United Kingdom shows the low price level before the war of Russian White Sea stocks, which at the time were rated among the best in Europe. Prices are for pine f. o. b. Archangel.

Dimensions.	First grade.	Second grade.	Third grade.	Fourth grade.
	Per M feet.	*Per M feet.*	*Per M feet.*	*Per M feet.*
3 and 11 inches	$47.93	$38.10	$25.81	$19.66
4 and 9 inches	47.93	38.10	27.04	23.35
3 by 9 inches	40.55	33.18	24.58	22.12
9-inch boards	47.93	39.33	29.49	19.66
8 and 7 inch battens	30.72	24.58	20.89	19.04
8 and 7 inch boards	34.41	29.49	22.12	17.82

These prices correspond to the Swedish prices covering shipments from the upper gulf, which in quality compare unfavorably with the White Sea stocks. The high freight rates from Archangel to the United Kingdom—about $4.50 per 1,000 feet, or $1.30 to $1.50 in excess of those from Swedish Norrland ports—may account to some extent for these low prices.

The competition from Riga on the Baltic was just as keen, although the lumber from this port is not so good as that from the White Sea ports. At the same time (1914) the following prices per 1,000 feet were obtained for different dimensions and grades of spruce f. o. b. Riga: 3 by 9 inches, first and second grades, $28.60; 3 by 11 inches, unsorted grade, $26.15; 3 by 9 inches, unsorted grade, $25.56; 3 by 8 and 7 inches, unsorted grade, $22.18. The freight rate from Riga to the United Kingdom was $2 to $2.10 per 1,000 feet.

The lack of a strong organization has been a great handicap to the Russian exporters. The Swedish exporters tried in vain, before the war, to come to an agreement with the Russian exporters similar to the one concluded with Finnish exporters.

The best lumber from Russia is exported from the Petrograd shipping district and from the White Sea region in northern Russia, but the shipping conditions in Russia are generally not so favorable as those in Sweden. The White Sea region is closed by ice during

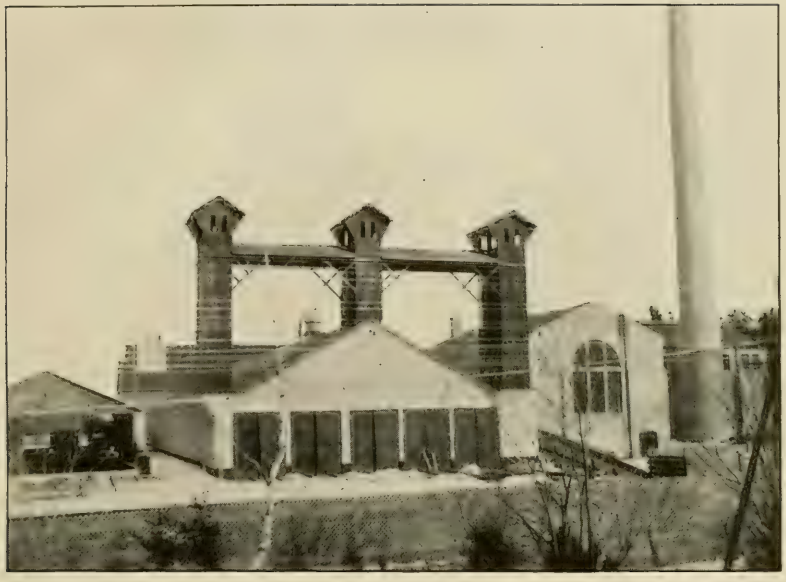


FIG. 92.—DRY KILN.

FIG. 93.—GRADING AND TRIMMING LUMBER ON DOCK.

Courtesy of State Forest Laboratory, Stockholm.

FIG. 94.—TRANSPORTING LUMBER FROM PORTABLE MILL IN INTERIOR TO RAILROAD STATION, SOUTHERN SWEDEN.

FIG. 95.—BARGE FOR LOADING LUMBER.

a part of the year, though recently it has been kept open by ice breakers much longer than in previous years. As the shipping season draws to a close, the exporters may resort to price cutting in order to be sure to dispose of their stocks. The Swedish exporters, on the contrary, may advance the prices too rapidly as soon as the market shows signs of improvement, sometimes interrupting negotiations of sale.

FINLAND.

The Swedish exporters, before the war, had considerable trouble with the Finnish exporters because the latter had been selling their lumber at lower prices. Finnish stock is generally somewhat inferior in quality to the average Swedish products, but Finnish lumber of the unsorted grade has often been sold, especially by small mills, at prices only slightly in excess of the price for Swedish fifth grade (better class of cull lumber). The Finnish exporters had profited by this policy in Belgium, Germany, and a few other markets, which were inclined to consider price more than quality. A change in this policy took place during the war, when the Finnish exporters established close cooperation with the Swedish exporters, and many of the small mills that formerly were the chief cause of this price cutting were taken over by larger concerns in Finland. The more favorable shipping conditions in Sweden than in Finland have materially helped the Swedish exporters.

NORWAY.

Between Norway and Sweden, there has never been any serious competition. Norway has developed over-sea markets to a great extent on account of its better steamship service, and, furthermore, Norway has specialized for years in planed lumber and box shooks while Sweden principally exports rough stock. The quantities exported from Norway are relatively small, and the Norwegian shippers have generally been able to obtain better prices than the Swedish shippers on account of their ability to ship during the part of the year when most of the Swedish ports are closed to navigation.

The Norwegians have always exported their lumber intelligently and have not dumped any quantities on the market, or otherwise caused prices to decline through lack of understanding market conditions. Close cooperation with the Norwegian shippers, therefore, has not been necessary to the Swedish trade, although actually cooperation between the Norwegian and the Swedish exporters' associations has existed for some time.

AUSTRIA AND RUMANIA.

While the timber in north Europe consists of pine and spruce of about the same species as the softwoods of Austria and Rumania, the lumber from the latter countries differs widely from the Swedish woods in quality and texture. The principal markets for the lumber from Austria and Rumania appear to have been near-by countries such as the Levant, northern Africa, and other Mediterranean countries. Until recently Swedish lumber has not been exported in

any quantity to these sections of Europe, and only in rare cases has lumber from Rumania and Austria entered into direct competition with Swedish lumber. There would probably be just as great a difference between Swedish and Austrain lumber as there is between Swedish lumber and, for instance, southern yellow pine; and the Swedes know the comparative values of Austrian lumber and their own, and price their stock correspondingly higher.

CANADA.

Some spruce from eastern Canada has been exported to the markets that take Swedish spruce and pine. Although in England, for instance, this competition has been keenly felt at times, on account of the extremely low prices of the Canadian spruce, the relative qualities of Swedish lumber, and Canadian spruce are well known in Europe and generally preference is given to Swedish lumber in spite of its higher prices. Swedish exporters sometimes complain of dumping practices on the part of Canadian exporters, but this competition has not been so keen as to prevent Swedish exporters from disposing of their stocks to good advantage.

In 1914 Canadian spruce was sold at the following prices, c. i. f. United Kingdom, in competition with Swedish spruce: 3 by 9 inches, $26.42 per 1,000 feet; 3 by 8 and 7 inches, $22.12 per 1,000 feet.

The high freight rates from Canada have handicapped the exporters there in placing their stock in Europe.

UNITED STATES.

One of the most serious competitors of Sweden in the lumber trade has been the United States. Particularly southern yellow pine, known abroad as pitch pine, has been exported in large quantities to markets that also take Swedish lumber. Upon a close investigation of the character of Swedish lumber and southern yellow pine, serious competition would seem unnecessary because southern yellow pine, in the grades usually shipped to the European markets, is superior to Swedish pine in almost every respect, and is considered so by both Swedish exporters and European importers. Nevertheless, southern yellow pine has often been sold at only slightly higher prices, and sometimes at lower prices than Swedish lumber delivered in the same markets. Not only southern yellow pine, but also other species of American lumber, such as Douglas fir and North Carolina pine, have been marketed in the same way. American exporters have not realized the limitations of Swedish lumber with regard to upper grades, long lengths, wide stock, etc., and the prices at which lumber has been sold by Swedish exporters. They have been advised by their agents simply that Swedish lumber is sold at such and such a price; and knowledge of the price of Swedish lumber without information as to grades, sizes, etc., did not offer a guide for American exporters in pricing their own stocks. Most of the American softwood lumber exported to Europe could hardly have been supplied from any other country in the world, with the possible exception of the west coast of Canada, which is too distant from European markets to be able to ship lumber in any quantities.

The following examples illustrate these conditions as late as 1918: A Swedish exporter quoted $59 per 1,000 feet, f. o. b. Swedish port, on a shipment of 3 by 9 inch pine planks of unsorted grade to the west coast of Africa. The freight rates, from the Swedish port to the port of destination were given as $58 per 1,000 feet. The same specification was submitted for quotation to an exporter on the Gulf Coast of the United States at the same time and the quotation given by this exporter was $30.72 per 1,000 feet, the freight rate being $78. This quotation covered southern yellow-pine lumber of merchantable grade, and the lumber was offered cut in specified lengths, whereas the Swedish exporter guaranteed only 17 feet average length for the whole cargo. It is evident that only lack of knowledge of market conditions could account for this low quotation by the American shipper when practically only two countries outside of the United States (Norway and Sweden) could have delivered this stock and these two countries maintain the same prices.

The following prices cover shipments of American pitch pine and Douglas fir to the United Kingdom during 1914: Rio Prime deals, $30.72, c. i. f. United Kingdom port; Douglas fir, merchantable deals, $27.04, c. i. f. United Kingdom port. These prices were only slightly above the prices paid in the same markets for Swedish planks of unsorted quality.

The Swedish lumber exporters expect that as the stands of timber in the United States decrease and stumpage values rise, adequate charges for stumpage will be included in the calculation of the cost of production and also that American lumber will be more carefully manufactured and the labor charges per 1,000 feet will be higher. Then the American shippers will be forced to ask higher prices for their lumber for export. There is no doubt that they will be able to keep their present markets, because most of the importers will be willing to pay higher prices for American lumber if the lumber is more carefully manufactured. The Swedish exporters would be interested in seeing American softwoods sold at higher prices in Europe, because firm prices on American woods would make it easier to maintain prices on Swedish woods.

HANDLING EXPORT SALES.

MANAGING THE SALES DEPARTMENT OF THE MILL.

It is fully realized in Sweden that it is one matter to manage a mill and another matter to handle the sales end of the business. Although these two operations are united in the activities of one company, they are of an entirely different nature and each requires a highly trained staff. The general manager of the export mill may usually take a more direct interest in the selling end of the business than in other branches, because the sales department is probably the most important and the financial returns of the company are largely dependent on the successful carrying out of an export policy.

In charge of the department of export sales, there is usually a highly trained sales manager conversant with conditions in Sweden, as well as in the principal importing countries. These sales managers have usually passed one or several years in various countries working in the offices of agents or importers, and have thus obtained a

good knowledge of conditions abroad. This gives them a better understanding of how to satisfy their customers and they are better able to adjust disputes that may arise between exporters and importers.

On the other hand, agents and importers frequently visit the Swedish concerns and the Swedish exporters, and the sales managers repay these visits frequently, in some cases even twice a year.

Although it is generally considered poor policy to effect sales when the Swedish lumber exporters visit their customers abroad, nevertheless many exporters do so. It is contended that these visits should have the character of a courtesy extended to the importers to ascertain whether the Swedish exporters can improve upon their services and that the sales should be left entirely to the agents. There is no doubt that this viewpoint is correct in many cases, especially when the market is dull, because to have the Swedish exporters travel abroad endeavoring to sell their stock would give importers the impression that it was necessary for the exporters to dispose of their lumber quickly.

It has always been a point with the Swedish lumber exporters to make their agents and customers understand their capacity, thereby avoiding unreasonable demands in regard to specifications and deliveries. It is easy to see how this mutual knowledge of conditions has an important bearing on the relations between exporters and importers.

The Swedish exporters have the advantage of being located at only short distances from the principal markets. It is no greater undertaking for Swedish lumber exporters to visit their customers in England or France than it is for a sawmill operator in the State of Louisiana to see his customer in the Middle West.

Only in rare instances do the same mills engage in both export and domestic business, and the sales manager therefore devotes his entire time to disposing of the company's lumber products for export. Where pulp mills are operated in connection with sawmills, the sales manager may also be called upon to dispose of the pulp-mill products. The sales managers are always in close contact with market conditions, through frequent visits to foreign countries, by keeping in close touch with the mill's agents, and most of all through the efforts of the lumber exporters' association, which will be discussed in a later chapter.

In advance of each cutting season the sales manager must estimate the possible demand for lumber in the various countries in order to enable the mill to cut accordingly. The mills in Sweden must cut large quantities for stock, as the seasoning process requires considerable time and it is easily seen, therefore, that it is of the utmost importance to cut such dimensions as are easily salable when the lumber is ready for shipment. The general manager of a sawmill company must coordinate the work of the sales manager in determining the demand for lumber in the future and the sizes to be cut, with the instructions that are given to the crosscutters in the forests, the log scalers in the pond, and the head sawyer in the mill. If any of these men should fail to work intelligently, the success of the sawmill business would be endangered.

The selling season generally starts during the autumn and early winter when the contracts are made for shipments at first open water

(f. o. w.). At other times of the year, minor sales are made, but during the late spring and summer the selling season is generally slack. Before each selling season, the sales manager must have made up a detailed inventory of the stock on hand and must also make an estimate of the quantities of lumber that will be ready for shipment at the opening of navigation the following season. Through many years of practice, the Swedish mills are generally able to give a very accurate estimate of the stocks that will be ready for shipment at first open water, even six months or more in advance.

Following is a typical Swedish stock list, showing quantities of different sizes of pine and spruce:

Sizes.	Pine.	Spruce.	Sizes.	Pine.	Spruce.
	M feet.	*M feet.*		*M feet.*	*M feet.*
4 by 9 inches	139	2	1¼ by 9 inches	218	85
3 by 11 inches	743	317	1¼ by 8 inches	248	99
3 by 9 inches	2,317	2,079	1¼ by 7 inches	218	317
3 by 8 inches	772	396	1¼ by 6 inches	69	99
3 by 7 inches	149	149	1¼ by 5½ inches	.....	30
3 by 6 inches	.....	34	1¼ by 4½ inches	50	10
3 by 5½ inches	.....	2	1¼ by 4 inches	99	10
3 by 5 inches	.....	2	1 by 9 inches	149	38
3 by 4 inches	4	.....	1 by 8 inches	188	61
2½ by 9 inches	6	.....	1 by 7 inches	297	287
2½ by 8 inches	297	103	1 by 6½ inches	119	50
2½ by 7 inches	1,980	1,782	1 by 6 inches	396	347
2½ by 6½ inches	1,129	594	1 by 5½ inches	198	188
2½ by 6 inches	347	792	1 by 5 inches	386	327
2½ by 5½ inches	.....	10	1 by 4½ inches	693	356
2½ by 5 inches	.....	50	1 by 4 inches	911	634
2½ by 4 inches	2	.....	⅞ by 7 inches	4	4
2 by 11 inches	2	2	⅞ by 6 inches	24	4
2 by 9 inches	103	79	⅞ by 5½ inches	16	2
2 by 8 inches	69	.....	⅞ by 5 inches	99	20
2 by 7 inches	40	63	⅞ by 4½ inches	168	30
2 by 6 inches	436	1,168	⅞ by 4 inches	396	59
2 by 5½ inches	139	277	¾ by 7 inches	4	2
2 by 5 inches	208	525	¾ by 6 inches	26	8
2 by 4½ inches	347	416	¾ by 5½ inches	30	6
2 by 4 inches	267	426	¾ by 5 inches	119	50
2 by 6½ inches	257	69	¾ by 4½ inches	139	69
1½ by 5 inches	139	.....	¾ by 4 inches	168	129
1½ by 4½ inches	20	.....			
1½ by 4 inches	20	.....	Total	15,443	12,672
1¼ by 11 inches	79	14			

These stock lists are sent to the companies' agents in different countries with special instructions in regard to the prices that the exporters expect to obtain and other details in regard to sales.

It is not customary in Sweden to take orders for larger quantities than the mills can handle, and contracts are seldom or never canceled because the mills are unable to make deliveries, except by reason of force majeure (act of God) or other causes beyond the shipper's control.

Formerly there was considerable jealousy among the Swedish shippers and they often showed unwillingness to assist one another in cases of an emergency shortage of stocks. Now, however, these conditions have changed, mainly through the work of the Swedish Lumber Exporters' Association. The mills can figure, as a rule, on being able to obtain lumber from their colleagues on very reasonable terms to make up for possible shortages. The Swedish shippers consider that if any shipper in their district should fail to make delivery according to contract, his failure would reflect not only upon himself but also, to a certain extent, upon all shippers in the same district; and when a district has once obtained a reputation for making unsat-

isfactory delivery, the prices obtainable by all exporters in the district will suffer accordingly. Assistance in filling orders may therefore be obtained readily, but the Swedish shippers do not rely upon it when they enter into contracts for the exportation of their products.

It may happen that the exporters find themselves unable, for one reason or another, to ship according to specifications. In such cases the exporters always wire the importers or agents to arrange for the necessary substitute dimensions to be shipped, but such changes are never made by reliable exporters without the consent of the importers.

EXPORT SELLING METHODS.

The sale of Swedish lumber for export may be effected in the following ways:

(1) Selling through a foreign agent on a commission basis.
(2) Selling through a domestic agent on a commission basis.
(3) Selling through own organization abroad.
(4) Selling outright to foreign agent.
(5) Selling outright to domestic export merchant.
(6) Selling outright to other mills.
(7) Exporting lumber to own organization abroad, which distributes lumber to wholesalers.
(8) Selling direct to importers abroad.
(9) Consigning lumber to foreign markets.

In this report the following terms will be used: *Agent*, meaning a representative of the mill, operating on a commission basis, and *export merchant*, a merchant buying outright on his own account from the mills and selling the lumber to customers abroad, either through agents or direct.

(1) *Selling through a foreign agent.*—This method is used by most Swedish mills in disposing of their lumber to foreign markets. The mills maintain one or several agents in foreign countries and most of these connections have been established for a number of years. The agents usually are given the sole right to handle the mill products in a given territory—in a part of a country, a whole country, or several countries. In many cases these agents are Scandinavians, who are generally preferred, because they usually have a better understanding of conditions in Sweden, in addition to their knowledge of the territory abroad where they operate.

These agents may have subagents in different places, but the exporters are not concerned with these subagents, who are compensated by the mill's representatives and operate on a commission basis, usually of 1 per cent. It would be preferable, no doubt, not to employ an agent representing other Swedish exporters in the same markets. This is not always possible, however, because the advantage to a mill of having an agent with a large clientele is too apparent to warrant such conditions. The markets for Swedish lumber are so extensive that agents representing several Swedish mills usually are able to dispose of their stocks without hampering the business of any one of the exporters whom they represent.

The duty of the agent is, in the first place, to sell the stock, but merely to sell would not be satisfactory to the Swedish exporters, who are very exacting in their requirements. The agent must endeavor to dispose of his stock in such a way as to satisfy the export-

ers. Otherwise it would be easy for an agent to pick out of each list the stock most readily salable in his territory and to leave the remainder to other agents. If this were done, the mills might find themselves with a large percentage of less desirable stock on hand at the end of each shipping season. Moreover, if the agents were not required to assist the mills in other ways than simply selling any stock that they might have a chance to dispose of with little effort, the mills, doubtless, would be able to handle their sales to better advantage themselves, without the assistance of intermediaries. The mills have found, however, that the services of an agent are generally advisable, because considerable adjustment is required in regard to both the specifications and the prices before a sale is made.

To understand the important assistance that the agents render to the exporters, it must be considered that the Swedish exporters spread over a large field and that they must endeavor to distribute their stocks in such a way that they will be as complete as possible in all markets where they sell.

It has been shown that the Swedish lumbermen cut their lumber so as to obtain the most economical result and that due regard is paid to the saving of raw material in sawing the logs. Furthermore, the logs are too small to yield any large quantities of wide stock or long lengths, and it is therefore apparent that good judgement must be shown in disposing of dimensions of which there is a limited supply. In regard to odd sizes, excess quantity of any one dimension, etc., considerable adjustment and discussion are always necessary before a sale can be effected. Evidently an agent in close touch with the importers can make a satisfactory arrangement more easily than the exporters, who have to take up these matters by correspondence or by wire. Right in this connection the agents perform their most valuable services. For instance, if an odd size of one grade is wanted, the agent must endeavor, in the first place, to obtain an extra price for this dimension and also to have the importer take other grades of the same dimensions, because otherwise the remainder of such odd stock would usually be a dead loss to the exporters, as it could not find another market readily.

If the mill's products are handled by several agents in different countries, it is of great importance to have each agent dispose of such stock as command higher prices in his territory than in the other districts, but at the same time not to spoil the stock list for the other agents. To accomplish good results along this line requires a detailed knowledge of market conditions in the different countries. The agents generally have a large clientele and may easily bunch several orders, thereby making up a cargo. This is of special importance to mills that do not have the benefit of direct steamship service to the principal markets.

From the agents the mills obtain information regarding market conditions. Although this information, in most cases, is reliable and of great assistance, there are cases where an agent desires to bring pressure to bear upon the mill and gives out information calculated to make the mill reduce the price in order to enable him to effect a sale. For instance, it is said that agents would wire their connections in Sweden that competitors, either in Sweden or in another country, had offered one dimension at such and such a price. It often happened that the agents' reports were only partly true because

the dimension referred to might represent only a few thousand feet in a cargo or might have been sold at a special low price as a compensation for concessions given by the importers. Formerly the mills had no means of checking up such reports and would often reduce their prices to make a sale. Now, however, the exporters in Sweden do not have to rely upon any other information than that which they receive from their association in Stockholm if there is any doubt about the truthfulness of a report from abroad.

Most of the foreign agents also maintain a chartering service and are in a position to obtain freight space and effect the insurance for the importers, if the lumber is sold f. o. b., and for the exporters if the cargo is sold on a c. i. f. basis.

In many cases the agents are required to guarantee the solvency of the importers to whom they sell. Evidently the agents are in a better position than the exporters to keep posted in regard to the financial position of the various importers. For this service the agents generally obtain about ½ of 1 per cent commission.

The commission received by the agents for making sales amounts to about 2 to 2½ per cent; in some cases it may be as low as 1½ per cent. Large exporters of recognized standing may obtain an agent's services on the last-mentioned terms because their stocks are easily salable. Sometimes agents may cede part or all of their commission to the importers, as a special rebate, in order to make a sale. This practice is vigorously opposed by the exporters, as it is considered a reduction on the selling prices established by the mills. No reputable agency does business in this way.

Valuable assistance is rendered by agents when claims are made by importers in testifying to the quality of the shipment received. The agent, having sold the cargo, is the logical person to represent the exporter. The agents are in most cases able to take care of the exporters' interests in a very satisfactory way and claims are usually settled amicably, thus preventing the expenses and trouble involved in having these matters settled by litigation. Some agents, however, have the unfavorable reputation of being inclined to settle such disputes in favor of the importers, in order to obtain their future patronage. Thus several agents may be known among importers as being "reasonable" in questions involving claims, but such practices can seldom be carried on for any length of time.

Formerly some Swedish exporters were more or less dependent upon financial support from their agents in the form of advances on the cargoes that the agents were to sell during the coming season. This system has now been abolished, as the mills can easily obtain financial support, if necessary, from Swedish banks. It is considered poor business policy to be financially dependent upon the agents in this way.

It is not believed that foreign agents hold stocks in Swedish mills, at least not to any considerable extent.

The agents, however, partly finance the Swedish lumber exporters in other ways, by making arrangements for credit for the importers, in cases where the exporters are unable to extend this themselves. This will be explained in a later section. Where the exporters draw on the importers, the agents generally attend to collecting the drafts. In drawing on the agents for the amount of the cargo, a discount of 2 to 2½ per cent is made on the f. o. b. value of the invoice. The

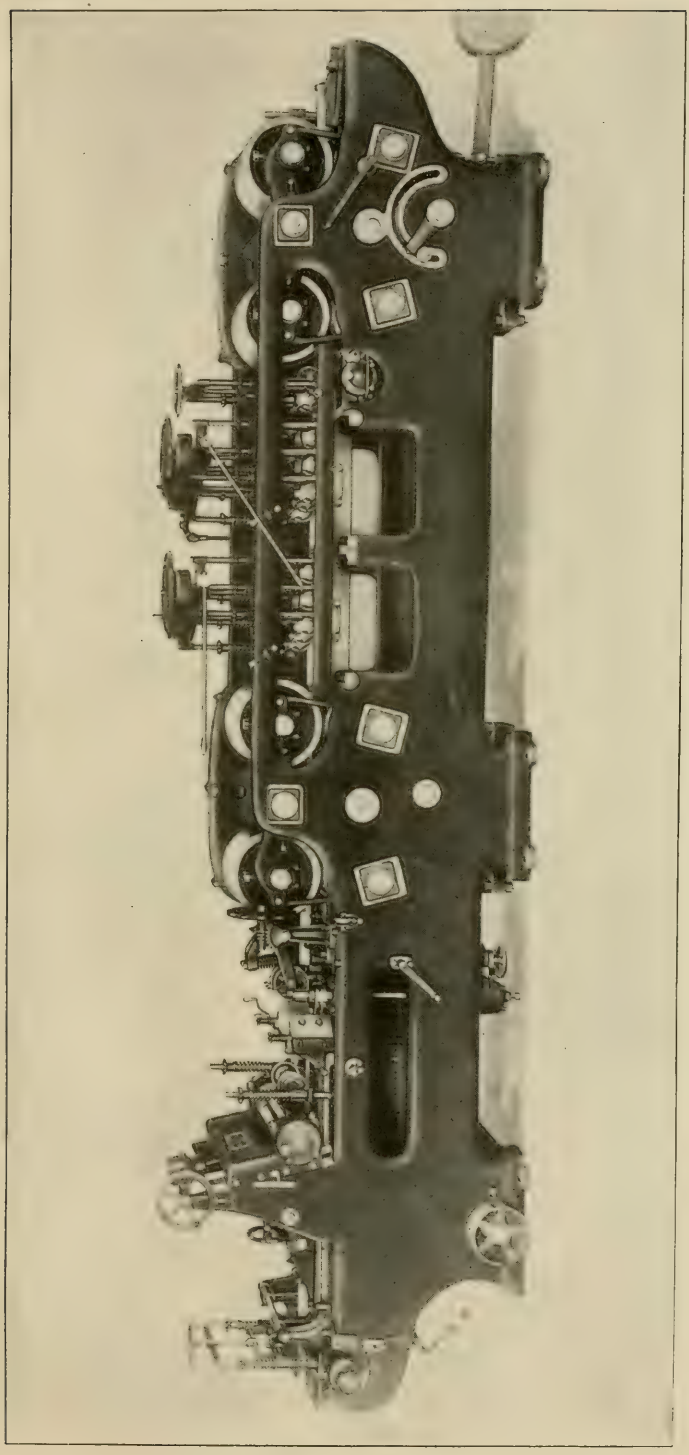


FIG. 96.— FAST-FEED PLANER

FIG. 97.—FIXED-KNIFE DRAWER.

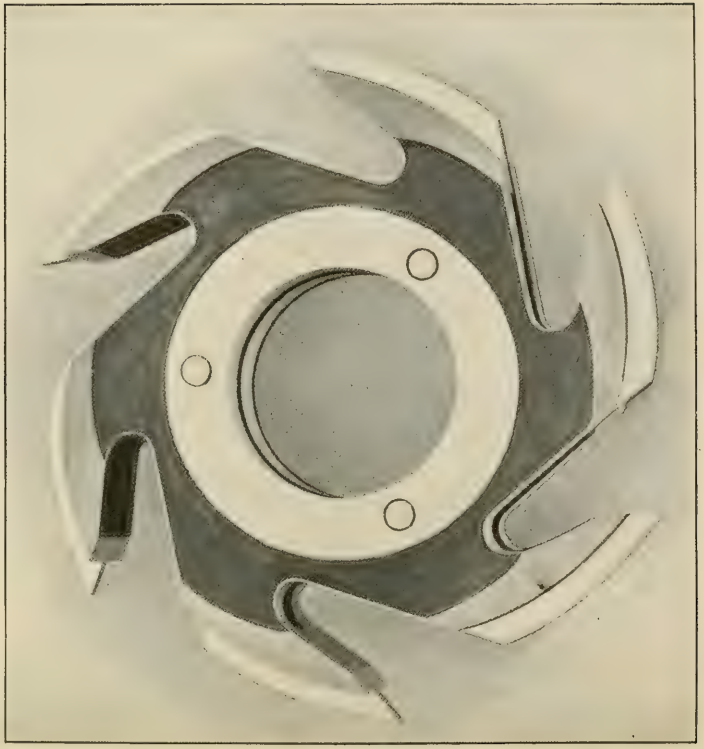


FIG. 98.—PATENT CUTTER.

total commission that the agents generally receive is thus 4 to 5½ per cent, made up as follows: Commission for sales made, 1½ to 2½ per cent; del credere, ½ of one per cent; cash discount, 2 to 2½ per cent.

The exporters, furthermore, often agree to settle, in part or in full, the agent's expenditures for postage and telegrams. The agents receive commission from the exporters only and not from the importers as well. Only in very rare cases does this commission, del credere, and discount exceed 5 per cent. This commission is considerably smaller than that received from exporters in some other lumber-exporting countries, but the agents state that they have little trouble in selling standard Swedish products, both on acccount of the well-established clientele that has been developed during the last half century and on account of the care with which the Swedish exporters fill their orders.

The Swedish exporters are opposed to having their agents buy outright on speculation. They want them to operate only on a commission basis. There is usually no written contract but only a "gentlemen's agreement" between the mills and their foreign representatives.

Direct dealing without the intervention of a middleman is often spoken of as the only desirable method of engaging in foreign trade. It is quite true that such dealing is ideal where it can be carried out but in many cases it is impractical because many matters need to be adjusted before a sale can be made. The agents therefore are not looked upon as "a necessary evil" by the Swedish lumbermen but as an advantageous medium by which to dispose of their stocks. If an agent conducts his business properly, the charge for his services is a small matter in comparison with the losses to which the mills exporting direct might be subjected if they lack knowledge of markets and customers.

Selling through foreign agents will probably be the principal system followed in Sweden in the future, as it has in the past.

(2) *Selling through a domestic agent.*—Mills located at a distance from the lumber centers and unable to keep in close contact with the market, and smaller mills not able to maintain a special sales organization for handling their output have frequently had recourse to domestic agents to handle their foreign sales. They give these agents the sole right to sell their lumber for export on a commission basis.

It is evident that such an agency, specializing in the marketing of lumber abroad, would obtain more satisfactory results than mills without the necessary expert assistance or mills that are out of touch with the market. Furthermore, as a rule these domestic agents have been able to obtain the same prices in the same markets for the lumber manufactured by small mills as for the products from larger mills.

The domestic agents generally cover a larger field than any individual mill and this advantage has been apparent to most of the small mills. These domestic agents often finance the small mills or own stock in the mills they represent. During late years this system of marketing has been gaining in favor, not only with small mills but also with larger concerns. Recently an amalgamation of several of the largest sawmills in Sweden has appointed a well-established domestic agent to handle its entire output. This agency now sells

annually about 15 per cent of all the lumber exported from Sweden. Similar systems have been successfully tried out in other lines.

Domestic agents receive a commission of about 2 to 2½ per cent, in addition to the customary cash discount from their connections in Sweden. The domestic agents have representatives attending to their sales in foreign markets, who are to be considered as subagents of the domestic agents and receive part of the commissions paid to the domestic agents by the mills.

In having their lumber handled in this way by large sales agencies instead of by a large number of small mills, a much firmer stand can be maintained by the Swedish lumber exporters as a whole toward the importers, because this system partly eliminates the danger of having lumber dumped by concerns that are financially weak. If the products of such mills are handled by the stronger concerns of domestic agents, these agents, as a rule, will support the mills financially to prevent any reckless price cutting. Besides lumber, these domestic agents sometimes handle also other forest products, charcoal, pulp, paper, timber, etc., and also maintain a chartering service and insurance agency.

The great majority of the Swedish domestic agents have conducted their business in such a way that they have been of material assistance to the lumber industry.

(3) *Selling through own organization abroad.*—Very few mills in Sweden are of so large a capacity as to maintain their own sales organizations abroad to handle their output exclusively. One of the largest mills in Sweden, which exports pulp, and iron and steel products, in addition to lumber products, maintains agencies in various countries in Europe, such as the United Kingdom, France, Belgium, and Germany. These agencies handle all the products of this company. This is evidently the most efficient way for large organizations to market their products in foreign countries, as it gives the exporters a better chance to push their products and to protect their own interests. Other agencies sometimes give too much consideration to their own profit at the expense of the shippers or do not show any particular willingness to exploit the markets for a new product as long as a satisfactory commission can be earned by selling well-established brands. The importers seem to favor dealings with branch houses because it is felt that many matters can be settled more easily and quickly by dealing direct with the exporters through their own organization, and dealings of this nature emphasize the responsibility of the shippers. To maintain such an organization, however, would be very expensive and would hardly be possible for most of the mills in Sweden, even of the largest size, if based on the sales of their lumber products alone.

For instance, a mill producing 60,000,000 feet per year would pay a commission to an agent during normal times of about 2 per cent of the f. o. b. value, or $25,000 to $30,000 per annum. It is evident that to sell all this lumber in one market would hardly be possible, and it would therefore be necessary to establish several branch houses in different countries, the expense of which would doubtless exceed the cost of commissions for agents.

(4) *Selling outright to foreign agent.*—It is the principle of the Swedish lumber sales policy that agents should not speculate with the stocks which they handle but only act as a middleman between ship-

pers and importers, operating on a commission basis. However, in some rare cases foreign agents may buy outright special stocks of Swedish lumber, such as small quantities of extra clear boards, etc., which they may distribute among their customers as a matter of accommodation. The cases where agents buy large quantities of lumber are rare during normal times and may be left out of consideration.

(5) *Selling outright to domestic export merchant.*—This selling policy is of a decidedly primitive character and is practiced only by mills that are unwilling to make any efforts to reach foreign markets. This system of selling is frequently seen in southern Sweden, however, where it is practically the only way for peasants and small producers to dispose of their lumber.

This form of selling can not be very remunerative to the producers. Export merchants buy products from all parts of the country, wherever they can obtain them at the lowest prices. The lumber is assembled at the various ports where the export merchants sometimes maintain yards. The grading is often done in a haphazard way and the product is not very uniform. The lumber is often branded with the merchant's brand. Some of these export merchants may also act as speculators in timber lands, buying small stands or contracting for cutting. The lumber is sawed in portable mills and taken down to the ports for shipment.

Although this system is confined almost entirely to southern Sweden, some small mills in the interior Provinces of northern Sweden sell their lumber in this way. This selling system is of small importance during normal conditions in northern Sweden.

The export merchants are often large trading companies handling a variety of Swedish products for export. Their activities are confined mainly to selling lumber in far-away countries and markets that have not been opened by regular exporters. Although it would seem advisable to have the mills take a more active part in marketing their lumber, it can not be denied that the trading companies and export merchants perform a valuable service in extending the markets for Swedish lumber. It is also convenient for many of the large exporters to sell to these trading companies and export merchants when the market is dull. The large companies usually brand their lumber in the usual way because this often makes the lumber more easily salable for the export merchants, if the mills have a good standing among the importers. As soon as a new market has been opened up by the trading companies, the exporters generally endeavor to reach it themselves.

(6) *Selling outright to other mills.*—In all districts in Sweden many small mills at times find themselves with surplus stock on hand, of which they can not readily dispose in the local market. While some of these mills may sell their lumber to export merchants, others prefer to sell their lumber to the regular export sawmills and planing mills. These companies are often in a better position to handle this stock than the export merchants, because they have the necessary facilities for remanufacturing defectively sawn material and because they regrade the lumber before it is shipped, thus making their stock homogeneous.

The export mills generally make a profit of $1.25 to $2.50 per 1,000 feet board measure by handling these stocks during normal times.

If the lumber is poorly manufactured, the export mills may prefer to run it through the planing mill, whereas the export merchant would sell this stock rough at a discount. It is to the advantage of the Swedish lumber export trade as a whole that the export mills acquire as large quantities as possible of small lots because such procedure insures uniformity of grade when the stocks are exported, and the exporters are thus in a better position to maintain the reputation that Swedish lumber has already established in foreign markets. The small stocks defectively manufactured and graded would not obtain the same prices in the export markets if their producers endeavored to export the lumber themselves. The quality of the wood from which the lumber of the small mills is manufactured may be just as good as that used by the export mills, and as long as the export-mill standards of grades are maintained no objection can justly be raised by importers. The sale of lumber by one mill to another in cases of emergency has already been explained.

(7) *Exporting lumber to own organization abroad.*—A few enterprising Swedish export mills have established themselves in foreign countries as importers, maintaining yards for the distribution of their products among other importers and wholesalers. Unfortunately the time chosen for the inauguration of this method by the Swedish export mills was not favorable, and, as far as could be learned, only one Swedish mill intends to continue this organization in the future.

If the sales can be handled on a large scale, this system has many advantages similar to those of a branch house. At the start, however, such concerns must have many difficulties to overcome in the way of competition and bad feelings on the part of agents and importers already established in the market where they operate. In old-established markets it may be questionable in many cases whether such steps would be advisable, but in new markets with inadequate import organizations this system may be practiced to good advantage, if properly handled, in extending the markets for Swedish lumber. It has generally been the experience of the Swedish lumber exporters selling their lumber in this way that lumber alone could not be handled successfully; other building materials had to be kept in stock at the same time.

It may be expected in the future that the Swedish exporters will not endeavor to handle their own lumber in foreign markets except as agents, as it is not considered good policy by most of the exporters to enter into direct competition with the foreign importers of Swedish lumber.

(8) *Selling direct to importers and consumers.*—The selling of lumber direct to foreign importers is not favored in Sweden. This system has been tried out many times by different mills, but in most cases the mills have come to the conclusion that an agent can best arrange business and that this method is the cheapest way of disposing of an average-sized production.

There are, however, some mills that prefer to do as much direct business as possible. Such shipments are usually made from small mills and are practically limited to countries with which Sweden is connected by regular steamship lines offering facilities for shipping lumber in parcel lots. This direct business is carried on especially with the Danish market. It is a common occurrence, particularly

during late years, to see thousands of carloads of lumber being shipped through Sweden every year by small, interior mills, even in southern Norrland, transferred on the ferryboat across the narrows between Denmark and Sweden, and distributed throughout Denmark even to the German–Danish border. This lumber is often inefficiently handled and sold to consumers, contractors, and wholesalers alike.

Such business naturally causes dissatisfaction among agents abroad, other shippers in Sweden, and larger importers, but with extended steamship connections with other countries this traffic may increase. In some countries, however, the importers themselves have endeavored to stop these direct shipments to consumers. In other countries the cooperation between importers is not so strong, but it is generally found that the small saving which the direct shipments may represent to the consumer does not offset the chances which he has to take in regard to obtaining satisfactory stocks. The small mills generally can not meet the requirements as satisfactorily as the larger exporters, and this fact will limit the growth of this direct trade.

In isolated cases large mills may sell direct to importers who have been customers for a long time and with whom they have been accustomed to do a direct business before the exporters made arrangement with other agents. Such exporters, however, sometimes show their loyalty toward their agents by giving them a commission on the sales made direct to customers in the agents' territories.

(9) *Consigning of lumber to foreign markets.*—There may be cases where the consigning of lumber is justified, particularly under abnormal conditions, but making a practice of consigning lumber is considered an inefficient and primitive way of selling lumber. It is used principally by firms of low standing, which are otherwise unable to obtain a market for their products.

Consigning and dumping are practically the same thing, because in disposing of the lumber in these ways no intelligent efforts are made to establish a permanent market. The sales are made in a haphazard way, and the consignor is not concerned about who purchases the stock or whether the stocks give satisfaction or not. As the material may be inspected before it is sold at auction, the buyers have to protect themselves. Consignments may in some cases be justified when a new market is to be opened, but all European markets know Swedish lumber and there should, therefore, be no need of making consignments of Swedish lumber on this account.

Consignments are usually made up of odds and ends left over in the yards at the end of each shipping season; they may also consist of scant or otherwise defective stocks, which the exporters would be unwilling to sell to their regular customers. These consignments may thus afford a good opportunity of disposing of such undesirable stock, but such methods, if continued, may have a depressing effect on the market. At any rate, it is more difficult for the owner of such stocks to obtain satisfactory prices when the lumber is stored in the importing countries and has already incurred heavy charges for freight, insurance, etc., and when every day of delay before a sale is made means increased expenses, such as loss of interest, storage charges, etc. The time will come when the entire stock must be sold even below market prices to cover the amount of these charges, and

exporters seldom realize the expected profits on such sales. This system of selling is generally condemned, and the lumbermen have endeavored through their association to check the practice of consigning lumber, making definite stipulations in regard to the percentage of the total stock that each member is allowed to consign. Five per cent is now made the limit. The importers also are generally opposed to consignments because they make the market unstable.

Formerly the consigning of lumber was looked upon by several financially weak concerns as an easy manner to raise money. With the improved financial conditions since the war, it is not believed that this reason will cause the Swedish lumber exporters in general to make consignments.

The principal ports to which Swedish consignments are made are London and Liverpool. During the war many cargoes were shipped to the United Kingdom on consignment because the exporters were frequently in a position to secure advantageous freight rates, and there was nearly always a good demand for lumber, so that the risk of having the stocks remain unsold for any length of time was very small. In such exceptional cases consignments are justified.

STANDARD CONTRACTS.

It is important to consider that all the Swedish shippers are selling their lumber on a standard contract, which has been agreed upon between the Swedish and Finnish shippers, on the one side, and on the other by the Timber Trade Federation of the United Kingdom and similar associations in other importing countries. This contract is also generally adhered to by the Norwegian shippers, so that all three countries are basing their sales on uniform contracts.

The following contract form is in use in Sweden. Several additional clauses referring mainly to the present abnormal conditions have been eliminated in this form because it is believed that these clauses are of only a temporary nature.

CONTRACT.

(F. O. B. Form.)

(Adopted by the Timber Trade Federation of the United Kingdom and the Swedish Wood Export Association and the Finnish Saw Mill Owners' Association.)

—1912—

Sold to.....

Bought of.....

through the agency of.....

the wood goods hereinafter specified, subject to a variation in shipper's option of 10 per cent more or less on any or every item, but not exceeding 20 standards on any one item, always provided that the total quantity is not varied except under the provisions of clause 5. Items of two to ten standards may be varied to the extent of one standard. In the event of over-shipment of any item, buyers are not compelled to accept or pay for anything beyond the quantity and margin stated in the contract. In the event of under shipment of any item, buyers are to accept or pay for the quantity shipped, but have the right to claim compensation for the quantity short-shipped. Each item of this contract to be considered a separate interest.
to be loaded at *Gefle* and to be ready for shipment *per 1st July, 1914.*

Other conditions as specified on the back.

Sellers' telegraphic address:
Buyers' telegraphic address:

SPECIFICATION.

Redwood 3rds ★★★

About	10 stds	3	x 9	à £11—	
"	100 "	2½	x 7	9. 5/—	
"	15 "	1¼	x 5	8. 10/—	
"	15 "	1	x 5	8. 10/—	
"	10 "	1	x 4½	8. 5/—	
"	25 "	1	x 4	8. —	

Redwood 4ths ★★

"	10 "	3	x 9	10. —	
"	20 "	3	x 7	8. 10/—	
"	30 "	2½	x 7	8. 10/—	
"	10 "	1¼	x 5	7. 10/—	
"	10 "	1	x 5	7. 10/—	

Redwood u/s K♔B

"	15 "	3	x 4½	8. 15/—	

Redwood 5ths A×C

"	11 "	3	x 5	6. 10/—	

Torrfuru 1sts S♔P

"	16 "	3	x 5	6. 10/—	

About 297 stds

London, the *25th March, 1914.* *Hull*, the *25th March, 1914.*

As Sellers' Agents, *As Buyers,*

CONDITIONS.

1. The Prices are in British Sterling:
- Sawn goods per St. Petersburg Standard of 165 cubic feet.
- Planed goods per St. Petersburg Standard of 165 cubic feet (nominal measure).
- Hewn goods per load of 50 cubic feet (Customs' Calliper Measure, excepting Upper Gulf hewn balks).
- Firewood per fathom of 216 feet cube.

All free alongside the ship.

2. Sellers undertake to supply sufficient ends, 6 to 8 feet for broken stowage only, at two-thirds price, but not exceeding 5 per cent, of the cargo unless otherwise agreed. Such ends to be regarded as included in the quantities named on the other side but to be disregarded in the calculation of average length. Shippers to have the right to supply up to the said 5 per cent of ends at two-thirds price, whether required for broken stowage or not.

3. The goods are to be properly seasoned for shipment to *the U. K.* and shall be of the shipper's usual bracking, average length and fair specification for such description of goods, and delivered to the ship in accordance with the Custom of the Port, the sellers not being responsible for any deterioration occasioned by circumstances beyond their control after the goods have left shippers' wharf properly protected.

4. Shiproom to be provided in due time by buyers with the customary time for loading. Buyers undertake that at least six clear days' notice shall be given to shippers direct before arrival of any steamer to load under this contract, such notice stating steamer's and charterer's name, and that full loading orders shall be in shipper's hands not later than six days before the notified due date of such vessel's arrival.

5. A margin of 10 per cent, more or less, but not exceeding 50 standards, is to be allowed to buyers for convenience of chartering, but when several shipments are made under the same contract, such margin shall only apply to the quantity by the last vessel. Should buyers under this clause demand an increase of total contract quantity sellers to give such increase in contract sizes, though not more than double the quantity of any item.

6. Shippers' liability to load at "first open water" shall not commence until the deliveries from the wharves and quays are entirely unhindered by ice. NOTE.—It is suggested that a clause to this effect be inserted in the Charter Party.

7. Marine insurance of cargo and freight advance to be covered by the buyers and opened as soon as tonnage is secured. It is understood that buyer's marine risk commences if and when the goods are loaded into lighters for shipment after receipt of the notice from steamer of her expected arrival.

8. Any freight advance to be settled by cash in exchange for captain's receipt, except on firewood when loaded by sailing vessel, in which case by thirty day's draft from date of bill of lading.

9. In case the manufacture and/or shipment of any of the goods be delayed or hindered by floods, drought, ice, destruction of mill and/or goods herein specified by reason of fire, strikes, lock-out, or any similar cause, shippers shall not be responsible for any damages arising therefrom, provided prompt notice be given to the buyer, but in such event only shippers have the right during *six* (*6*) weeks from stipulated date of delivery of completing the contract, but on the expiration of such extended time, if shippers then declare or have previously declared their inability to deliver, buyers shall thereupon have the option to be promptly declared, of canceling the contract, or continuing the same for such date of delivery as may be mutually agreed upon, but in any event not later than the following f. o. w.

A strike or lock-out of the shippers' men only shall not exonerate them from any demurrage for which the charterer may be liable under the charter, if by the use of reasonable diligence the shipper could have obtained other suitable labor.

10. It is mutually agreed that, should war, probibition of export or blockade prevent shippers from shipping or buyers from lifting the goods herein specified within the time stipulated in the contract, this contract shall be canceled for goods not delivered.

11. Payment to be made on receipt of and in exchange for shipping documents by approved acceptances of sellers' or authorized agents' drafts, payable in London at *four* months from date of bill of lading, or at buyer's option, in cash less 2½ per cent discount payable in London. Sellers to give notice of vessel's arrival in the case of steamers by telegraph, and buyer's option as to mode of payment to be declared on receipt of such notice.

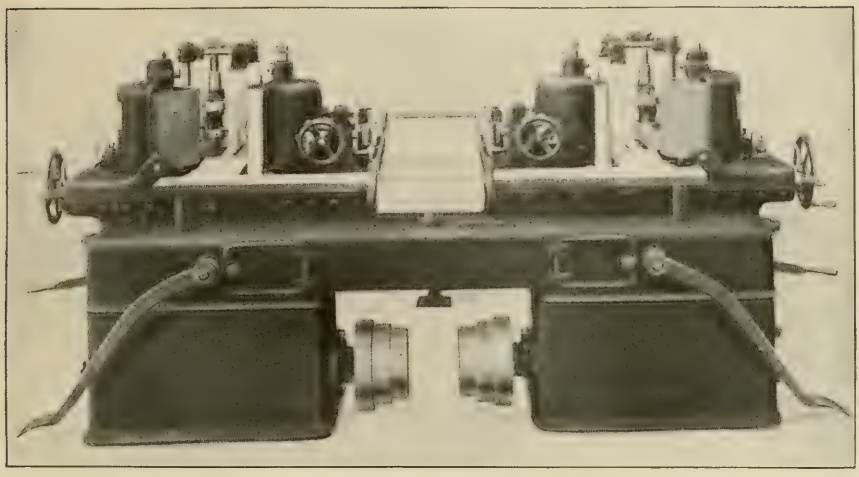


FIG. 99.—DOUBLE RESAW.

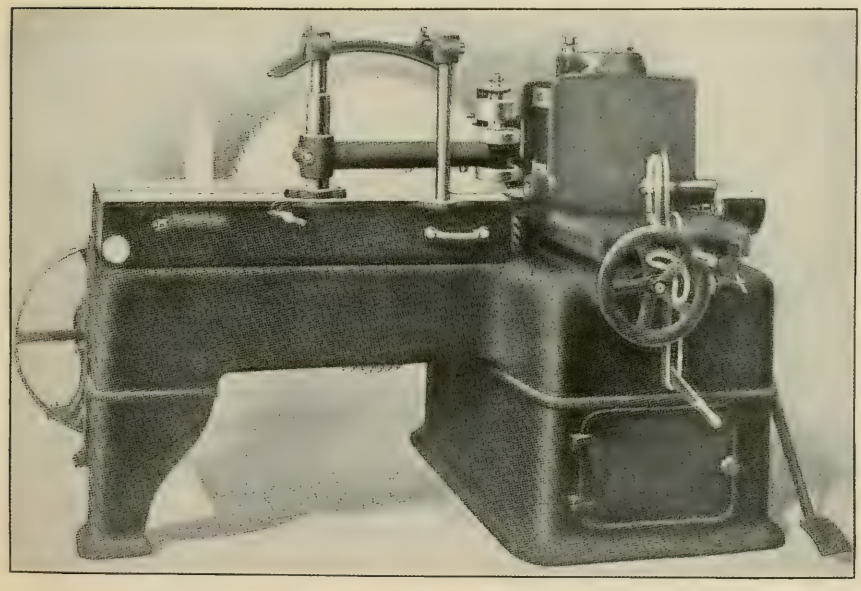


FIG. 100.—RESAW.

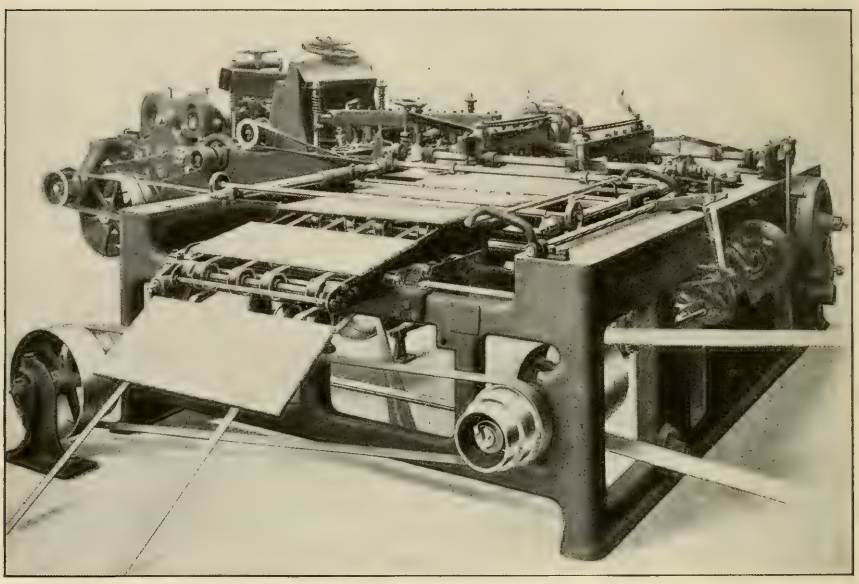


FIG. 101.—AUTOMATIC BOX MACHINE.

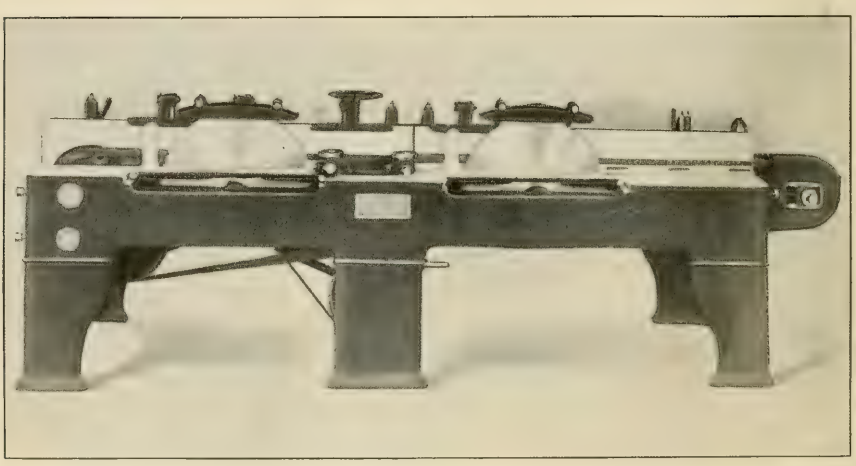


FIG. 102.—DOUBLE RESAW FOR BOX MATERIAL.

12. Should any of the goods not be removed by *September 1, 1914*, payment to be made in the manner provided above against approximate invoice of the said date, the goods then remaining at the risk of the buyers but at the expense of the sellers, provided, however, that if the goods are still unshipped by 31st August of the following year, the buyers shall pay 5s. per standard rent to the sellers. Buyer's liability to pay for the goods under this clause shall, however, be suspended if the failure to remove is due to any of the contingencies covered by clause 9, and the drawing date shall be postponed for a period corresponding in length to the duration of the delay.

13. No complaint or claim will be recognized by sellers upon any goods shipped under this contract, unless reasonable particulars are given to agents within 21 days from date of ship's final discharge, but any claim on the condition of the goods shall be announced within 14 days thereof. No claim shall be recognized on any item or separate parcel shipped which has been broken into; but otherwise buyers shall be at liberty to deal with any items or parcels on which there is no complaint without prejudice to their right to claim on any intact items or parcels (including separate bills of lading delivered overside) under the arbitration clause. An item or parcel shall be considered to be intact if it can be produced to the arbitrators in its entirety as discharged.

14. Property in goods to be deemed for all purposes, except retention of vendor's lien for unpaid purchase price, to have passed to buyers when goods put on board.

15. The goods to be shipped under as many bills of lading as may be required by buyers, provided that the total number issued shall not exceed 5 per 100 standards, and that for any B/L in excess, buyers shall pay one guinea.

16. Should any dispute arise under this contract which it may be found impossible to settle by amicable arrangement, the same shall forthwith be referred to the decision of a third party to be mutually agreed upon, or in default of agreement to two arbitrators, one arbitrator to be appointed by the sellers and one by the buyers. Such arbitrators shall, previously to entering upon the arbitration, appoint an umpire, and the arbitration shall be subject to the English Arbitration Act of 1889, or any subsisting statutory modification thereof or substitution therefor. Buyers shall not reject the goods herein specified, but shall accept or pay for them in terms of contract against shipping documents. In the event of either side failing to appoint their arbitrator within seven days after being requested through the agents under this contract so to do, the arbitrator thus required shall be appointed by the President, or failing him by the Vice-President of the Timber Trade Federation of the United Kingdom, on the application of either party. In the case of a claim not exceeding £25, or on less than 25 standards the dispute shall, if not amicably settled, be referred to one arbitrator, and in default of the parties agreeing on his appointment, he shall be appointed by the President, or failing him by the Vice-President of the Timber Trade Federation of the United Kingdom. Every arbitrator or umpire shall be selected from members of the timber trade, or from the arbitrators approved by the Timber Trade Federation of the United Kingdom, or by the Scandinavian Sawmillers' Associations. Any award shall be final and binding upon both parties. The costs of such arbitration shall be left to the discretion of the arbitrators or umpire. In deciding as to costs, the arbitrators or umpire shall take into consideration the correspondence between the parties relating to the dispute, and their respective efforts to arrive at a fair settlement. This agreement shall be made a rule of court on the application of either party.

The above clause not to apply in case of any of the goods being shipped to the colonies or Mediterranean ports.

In the contracts the sellers are given some latitude in regard to changing the specifications. While in other countries exporters have sometimes misused this right and have shipped specifications of an entirely different nature for those desired by the importers, this complaint has seldom or never been heard in connection with shipments from Sweden, Norway, and Finland. The buyer also has a right to make some changes in the specifications, but the difference between the seller's right and the buyer's right in this respect is that the seller has only the right to increase or decrease the quantity of the different items, but must always ship the total quantity specified in the contract, whereas the buyer can vary the total quantity to be shipped, up to 10 per cent, but the quantities covering this variation must not exceed 50 standards (99,000 feet board measure). If the shipper is supplying excess quantities beyond the variation to which

he is entitled according to the contract, the importer may refuse to accept these excess quantities. If the exporter, on the other hand, supplies smaller quantities than he should according to the contract, the buyer must both pay for and accept these quantities shipped, but he can afterwards make a claim for losses caused by the exporter's failure to carry out the contract. In regard to short lengths, the seller is compelled by the contract to furnish lengths of 6, 7, and 8 feet up to and including 5 per cent of the whole cargo, and the seller also has the right to demand that this quantity be included in each cargo, whether short lengths are needed for stowage or not.

There are no special rules covering the distribution of this stowage among the different items, and certain dimensions always are accompanied by a larger percentage of short lengths than other dimensions dependent upon the percentage of short lengths produced by the mill in each case. The contract generally stipulates that the exporter must make up the shipment of a fair specification and this stipulation is to some extent a protection for the importer in this respect. The short lengths are not taken into consideration in calculating the average length of the whole cargo. The contract specifies that the lumber must be properly seasoned and graded according to the usual established rules of the particular exporter. One exporter is not dependent upon the grading rules that other exporters in the same district may use.

After the lumber has been removed from the dock and is properly protected in the barges, the exporters are not responsible for any deterioration.

The following is the form for the bill of lading:

Shipped in good order and condition by ——— in the good steamship called the *Pan*, whereof *Nordgren* is master for this present voyage, and now lying in Gefle and bound for *Hull* (*Dock as ordered on arrival*) via other loading ports, as per charter, dated *June 20, 1914* (with liberty to call at any ports in any order, to coal, or for loading or discharging cargo under the ice clause—No. 8—in the undermentioned charter party, or otherwise, to sail without pilots, and to tow and assist vessels in distress, and to deviate for the purpose of saving life or property).

★★★
K♔B 26,339 pieces 3×9, 4½; 1¼×5; 1×5, 4½×4 inches deals, battens and boards.
of which — pieces on deck at charterers' risk. And to be delivered in the like good order and condition at the aforesaid port of *Hull as above*.

The act of God, the King's enemies, restraint of princes and rulers, perils of the seas excepted. Also fire, barratry of the master and crew, pirates, collisions, strandings and accidents of navigation, or latent defects in, or accidents to, hull and/or machinery, and/or boilers, always excepted, even when occasioned by the negligence, default, or error in judgment of the pilot master, mariners, or other persons employed by the shipowner, or for whose acts he is responsible not resulting, however, in any case from want of due diligence by the owner of the ship, or by the ship's husband or manager.

unto *Order* or his or their Assigns, he or they paying freight for the same as per charter party dated *June 20, 1914*, all the terms and exceptions contained in which charter are herewith incorporated.

General average payable according to York Antwerp Rules, 1890, excepting that jettison of deck cargo (and the freight thereon) for the common safety shall be allowed as general average.

In witness whereof the master or agent of the said ship hath signed three bills of lading all of this tenor and date, any one of which being accomplished the others to be void.

Dated in Gefle this *9th day of July, 1914*.

Quality, condition, and measure unknown.

J. NORDGREN,
Captain.

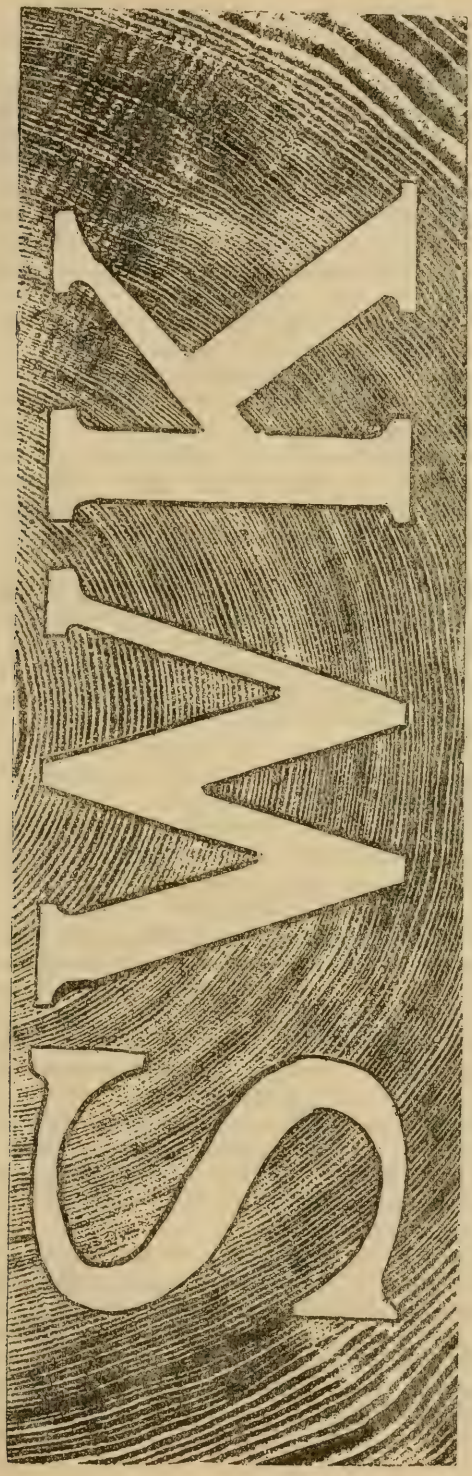


FIG. 103.—Spruce lumber, showing brand and dense growth.

BRANDING.

When the branding system was started in Sweden is not recorded but it is thought to have been in existence for 100 years or more. The branding of lumber is in general use all over Sweden. There is no exporter of any importance in the country who does not in some way or other trade-mark his lumber for export.

The Swedish brands usually designate the name of the shipper and the grade of lumber. Some mills also find it desirable to differentiate in the brand between pine and spruce and also between planed lumber and rough lumber.

The effect of trade-marking lumber can not be overestimated, and it would be impossible to consider the success of the Swedish lumber exporters without giving attention to their branding system. The Swedish lumber exporters contend that unbranded lumber indicates that there is something wrong with the product, because the producer or exporter has shown himself unwilling to stand behind it.

It has been mentioned that certain mills or districts obtain better prices than others. These higher prices are due in many cases to the fact that the mill or the district has been careful for years in maintaining its reputation by always shipping the lumber up to grade and otherwise carefully fulfilling its contracts. Many importers are willing to pay an extra charge to be assured that the lumber will be shipped strictly according to contract. The effect of the brand is not restricted, however, to the importer. The wholesalers and consumers generally pay as much attention to the brand as the importer and it is frequently heard abroad that customers specify the same brands year in and year out. The demand for such branded lumber therefore is being created not only by importers but also by their customers—wholesalers and consumers.

It is readily seen that these conditions tend to increase the demand for the different brands of Swedish lumber and that price cutting between the exporters to some extent will be eliminated by having each mill cater to the old-established customers. The larger the clientele of the exporter, the more careful he must be to retain his customers by maintaining the established standards of grades.

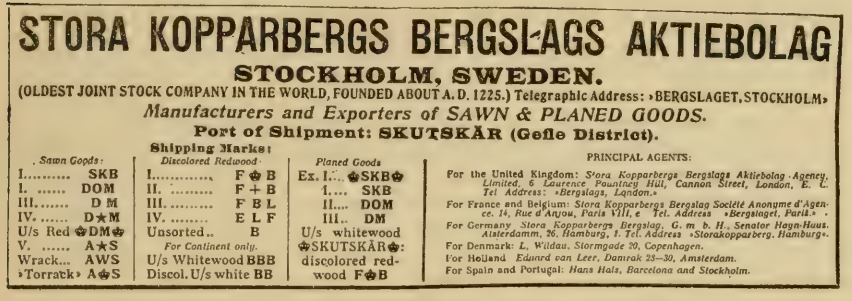
Indicating the grade on each piece is of the greatest importance. In case of claim, it would always be easy to arrive at a conclusion, because every piece of lumber bears the quality mark and no tampering with the grades is possible. In cases where only the shipper's name is indicated on every piece of lumber or the lumber does not bear any trade-mark at all, tampering with the grades is easy and of frequent occurrence. If the importer buys lumber of one grade and sells it as a higher grade, the consumer will not be protected and the resulting dissatisfaction will eventually cause a decreased demand for inadequately branded stock.

In the case of lumber branded with the shipper's name and the quality at the same time, it is impossible to misrepresent the quality upon which basis the lumber is sold and although the prices may be higher before it reaches the consumer, he always knows what he is paying for. In case lumber not up to grade has been shipped, no responsible shipper could afford to disregard the settling of such claims on branded stock, and knowing this, the agents handling such branded lumber are likely to work on a lower commission basis

because handling such stock involves less trouble. The brand is also a guaranty for the importer and he is willing to pay for this assurance of the shipper's responsibility.

To show the importance that is attached to the branding of Swedish lumber, it may be mentioned that some time ago a foreign Government offered for sale at low prices stocks shipped by comparatively unknown Swedish exporters. These stocks were open for inspection at the port in the foreign country. In spite of the low prices, most of the importers preferred to pay several dollars extra for branded lumber from old established concerns in Sweden, though the lumber offered by the Government was said to equal the branded lumber in quality.

The branding of pine and spruce separately is not general but it is seen at times. The pine, for instance, may be branded in blue and spruce in red. Planed lumber is usually branded with a special symbol to distinguish it from rough stock. Several Swedish exporters give as a reason for this practice that Swedish lumber is often planed unsatisfactorily in foreign countries, and if such planed stock is sold carrying the brand of the Swedish shipper of the rough stock it may misrepresent the Swedish shipper unless there is


STORA KOPPARBERGS BERGSLAGS AKTIEBOLAG

STOCKHOLM, SWEDEN.

(OLDEST JOINT STOCK COMPANY IN THE WORLD, FOUNDED ABOUT A. D. 1225.) Telegraphic Address: »BERGSLAGET, STOCKHOLM«

Manufacturers and Exporters of SAWN & PLANED GOODS.

Port of Shipment: SKUTSKÄR (Gefle District).

Shipping Marks:

Sawn Goods:		Discolored Redwood:		Planed Goods	
I.....	SKB	I.....	F ♔ B	Ex. I...	♔SKB♔
I.	DOM	II.	F + B	I....	SKB
III.....	D M	III.	F B L	II....	DOM
IV.	D★M	IV.	E L F	III..	DM
U/s Red	♔DM♔	Unsorted..	B	U/s whitewood	
V.	A★S	*For Continent only.*		♔SKUTSKÄR♔:	
Wrack...	AWS	U/s Whitewood	BBB	discolored redwood	F♔B
»Torrack«	A♔S	Discol. U/s white	BB		

PRINCIPAL AGENTS:

For the United Kingdom: *Stora Kopparbergs Bergslags Aktiebolag Agency, Limited, 6 Laurence Pountney Hill, Cannon Street, London, E. C. Tel Address: »Bergslags, London.«*

For France and Belgium: *Stora Kopparbergs Bergslag Société Anonyme d'Agence. 14, Rue d'Anjou, Paris VIII, e Tel. Address »Bergslagel, Paris«.*

For Germany *Stora Kopparbergs Bergslag, G. m. b. H., Senator Hagn-Haus. Alsterdamm, 26. Hamburg, I. Tel. Address »Storakopparberg, Hamburg«.*

For Denmark: *L. Wildau, Stormgade 20, Copenhagen.*

For Holland *Eduard van Leer, Damrak 23—30, Amsterdam.*

For Spain and Portugal: *Hans Hals, Barcelona and Stockholm.*

FIG. 104.—Sample of Swedish advertisement, showing brands.

some indication that rough stock was shipped from Sweden and that the defective manufacture, therefore, is due to causes beyond the exporter's control.

Some firms may also make special grades and brands for discolored lumber. Particularly the mills cutting a considerable percentage of the upper grades of stock may obtain a better price for discolored lumber by separating it from the other grades. Many mills have three or four grades of discolored lumber. This stock is always specially designated as discolored stock in order to prevent tampering with the grades.

Sawmill companies operating several mills in different districts may have different symbols indicating the point of shipment. Sometimes the mills have different symbols for each country of destination, but this is not always considered good policy.

There is a variety of types of brands. Usually the brands are made up of the initials of the mill or mill owner, and the different qualities may be designated by a crown, star, a plus or a minus sign, or by the order in which the letters are placed. The following are some of the Swedish lumber brands for various grades of lumber and places of shipment.

HUDIKSVALL SHIPMENT.

Sawn lumber:	
First grade	H ♔ H
Second grade	H ♔ H
Third grade	H H H
Fourth grade	ß H B
Unsorted grade	+H H+
Fifth grade	M D M
Sixth grade	M M M
Planed lumber:	
First grade	♔ H T A ♔
Second grade	H T ♔ A B
Third grade	H T A B
Unsorted grade	H W A L L

SKELLEFTEA SHIPMENT.

Sawn lumber:	
First grade	J M A
Second grade	R K L
Third grade	U N D
Fourth grade	B A B
Fifth grade	N P U
Sixth grade	B ● A
Unsorted grade	B U R E
Planed lumber:	
First grade	B U ♔ R E
Second grade	B U ★ R E
Third grade	B A B
Unsorted grade	B U R E

Symbols are usually selected for the different grades in such a way that tampering would be difficult. Sometimes the entire name of the mill may be made the basis of the brand, and this is very effective if the name is short. Some mills register their brands, but this is not usually considered necessary, although several shippers in Sweden and in neighboring countries have taken the same branding symbols.

Both in Sweden and abroad there have been published keys to the different brands. The Swedish edition is especially complete and is called the Timber Trades Handbook, published by Th. A. Askergren, Stockholm. It contains very valuable information in regard to the shipping marks in Sweden, Norway, Finland, and Russia, and general information as well about each one of these countries. The first part of the book contains data about the forests and the lumber and pulp industries in each country, and in the section containing the directory of the various exporters complete information is given in regard to the mills, their equipment, production, administration shipping ports, and agents, and a complete record of the different brands, covering all grades and species.

A book called Shipping Marks on Timber is published by the Timber Trades Journal, of London. This book contains a key to the different brands for Sweden, Norway, Finland, Russia, Germany, Canada, the United States, and a few other countries.

Branding in Sweden may justly be termed the backbone of the lumber export trade, and it would serve the same purposes for American lumber exporters if it were generally adopted in the United States. The branding of lumber for export in the United States might be handled in the most efficient way by having the various lumber associations arrange for a uniform system of desig-

nating shippers' names, quality, species, etc. The brand could also indicate that the shipper was a member of one particular association. In this way greater uniformity would be feasible and it would be easier for the importers to acquaint themselves with the meaning of these symbols. Probably the branding would also redound to the benefit of the reliable shippers if the association could exercise a certain control of the use of the brands by refusing membership to notoriously dishonest exporters. It would be advisable for American shippers to register their brands. The quality of the lumber should be indicated by the brands; otherwise it would still be easy for middlemen, importers, wholesalers and retailers abroad, to tamper with the grades.

TRADE JOURNALS—ADVERTISING.

One lumber trade journal in Sweden has a wide circulation among the exporters in that country and in Norway, Finland, and Russia, and also among the importers in the various countries. This publication, called The Swedish Timber Trades Journal, is published in Stockholm and contains valuable information on the lumber market in the different countries, besides various articles on freights, production of lumber, and matters of local interest. The leading articles in this paper are printed in English also.

Advertising systems in Europe, as a whole, are not developed to such an extent as in the United States. In many cases some old-established firms contend that they are so well known that they do not have to advertise. Many firms seem to have all the business they can handle and are unwilling to enlarge the scope of their activities. In this respect business generally is conducted in a much more conservative way than in the United States.

The lumber export trade in most of the European countries belongs to one of the most conservative branches of commercial activities, and the advertising of lumber or the advocating of different species of lumber for different uses is not usually seen. The Swedish lumber exporters do not avail themselves of the press to further their business to any great extent.

The more important Swedish exporters limit their advertising to simple statements in Swedish and foreign lumber journals, usually containing only the name of the shipper, the capacity of his mill, shipping marks (brands), and the name of the agent handling his products. No efforts are being made to push the different products in other ways through the press or to point out the special features in connection with the shipments from any one exporter.

In figure 104 is seen a typical Swedish advertisement of this nature, representing one of the largest shippers in northern Europe. The mere fact that this company has been established since about 1225 A. D. would probably give this company a standing without any further explanation. The importance that the Swedish exporters attach to their brands is seen from the fact that these brands are nearly always inserted in the advertisement.

Occasionally Swedish lumber exporters also take an active part in properly advertising their stocks in foreign markets. Figure 91 shows such an example, giving a price list, accompanied by an explanation in Greek about the Swedish exporter and his products,

steamships, etc., whose lumber the importer who issues this catalogue is handling. It must also be noted that the trade-marks occupy a very prominent place in this price list, which shows that even in so small and unimportant a market as Greece the trade-marks are considered essential for the efficient marketing of Swedish lumber.

SWEDISH LUMBER EXPORTERS' ASSOCIATION.

The excellent results accomplished by the Swedish lumber exporters in extending their markets all over the world would not have been obtained were it not for the important work of the Swedish Lumber Exporters' Association. This association has been in existence for many years, but only during the last decade has it played any important part in the export trade. At present the membership represents the shippers of more than 90 per cent of the lumber exported from Sweden. The outsiders consist mainly of smaller mills which do not produce sufficient quantities to make any difference in the program of the exporters' organization. The main office of this association is located in Stockholm; there are several branches in the principal shipping districts throughout Sweden.

The membership fee paid in Sweden is rather low. During normal years the membership fees amounted to about $20,000, but at present they are somewhat higher. The expenses are chiefly for administration and office expenditures, as generally money is not given out for advertisements, exhibits, etc.

The principal object of this association is to maintain a certain price standard on lumber for export. In advance of each selling season a special committee of the members decides upon the minimum prices for each district which the members must obtain. Before the war there was no written contract in regard to the minimum prices; the understanding among the members was considered a "gentlemen's agreement." During the war, however, stricter measures were taken to prevent the members from underselling one another, after the placing of orders for the Allies was put into the hands of the British Timber Controller. It was evident to the Swedish exporters that weakness on the part of any of their members in their selling policy would immediately have a serious effect on the prices for all mills. Special contracts, accordingly, were signed by all members, whereby they bound themselves to observe the rules in regard to the general selling policy, minimum prices, etc., established by the association. A board of 17 representatives from all shipping districts was appointed by the members, and detailed minimum price lists were issued covering each dimension and grade in each shipping district. The different countries of destination were given special schedules. The prices were changed from time to time to follow the market. Special attention was given to extra charges for odd sizes, etc.

The members were required to establish a certain financial guaranty to which the association had access in case any member should break the contract, and heavy fines were imposed by the association for such breach of agreement. Furthermore, it was left to this commission to pass on important questions in regard to the general selling policy of the members. This arrangement is still in effect and will probably be maintained.

The members must report the details of sales as soon as they are made. This information must contain a detailed account of the terms of sale, specifications, prices, and country and region of destination, but not the name of the importer nor the port of destination. This information is communicated to the other members, who thus are able to follow the market independently of any information from the outside. This system stood its test during the latter part of the war and the Swedish lumber exporters were able to raise their prices on their products to correspond to the heavy increases for raw material and labor.

This cooperation among the exporters in Sweden enabled them to deal successfully with the strongest and most powerful factor in the lumber import trade that the world has ever seen. That this cooperation will continue is certain, particularly since the Finnish Association has entered into a close connection with the Swedish Association, establishing a fixed relation between the base prices in the two countries.

Important work was accomplished before the war by the Swedish Association in having the contracts covering lumber sales for export standardized for all mills. During the war several important changes were made in the established form of the contract, such as selling on a guaranteed rate-of-exchange basis, all of which were taken up by the association in behalf of its members.

Various efforts have also been made by the association, through the district branches, to stabilize the prices on saw logs delivered at the main floating rivers. It can not be said that the association has been so successful in this undertaking as in fixing prices for lumber export. If it were only a question of competition among the association members in regard to the purchase of saw logs, the matter would not be so difficult, but many outsiders and pulp mills offer keen competition, and the base price fixed at the beginning of a season is seldom adhered to.

The curtailing of production by mutual agreement has not often been necessary. The mills generally judge for themselves in advance of each season what the prospects will be for the next sales campaign, and as they generally have the same customers year after year, each mill decides its own policy.

ARBITRATION SERVICE.

Before the war the association instituted an arbitration service in several of the principal importing countries. It was frequently found that importers made unreasonable claims, knowing that the exporters or their representatives could not always check up their statements. Swedish lumber experts are stationed in different lumber centers in Europe and in case of claims the assistance of these experts can be demanded. The contracts usually stipulate that the decision of these experts is to be final.

In the United Kingdom, during 1914, the association experts acted in 31 cases of claims involving approximately 6,000,000 feet board measure of sawn and planed lumber. The total amount of claims demanded was about $8,100, of which about $3,200 was granted. In 12 cases the complaints were poor quality; in 3 cases poor quality and excess of wane; in 3 cases, excess of wane; in 2 cases, excess of

wane and excess percentage of short lengths; in 1 case, excess of wane, discoloration, short average lengths, etc.; in 1 case, scant lumber; in 1 case, rot; in 1 case, discoloration; in 1 case, warped stock; in 1 case, careless trimming; in 1 case, scant thickness; in 1 case, defective tying of bundled goods; and in 1 case poor manufacturing. Two cases were unjustified claims. Considering that the United Kingdom is the most important market for Swedish lumber, the number of complaints is insignificant.

The experts are paid chiefly by the Swedish Exporters' Association, but their services have been considered very valuable by both exporters and importers. Besides their assistance in the satisfactory settling of claims, the mere presence of these men prevents many unreasonable complaints. Among the reliable importers this arbitration system has been looked upon with favor because it proves that the intentions of the Swedish shippers are to make right what might be wrong. The expense of maintaining the service is considerable, but it is estimated that the Swedish exporters indirectly are deriving great benefits. The value of this assistance must be estimated not by the number of disputes that the arbitrators may settle in the exporters' favor but rather by the elimination of many complaints through the presence of these representatives abroad.

ATTEMPT TO ESTABLISH UNIFORM GRADING RULES.

Efforts made by the association to establish uniform grading rules for its members have not succeeded. This circumstance must be seen, however, in the light of the proverbially conservative policy of the Swedes in all their dealings. Certain mills long ago established a standard of grades, which is known to their customers, and change in this standard of grades would give their old-established connections reason for dissatisfaction. The association, therefore, has not been able to establish uniformity in this respect, although the question has been considered.

CHARTERING BUREAU.

One of the most recent and most successful activities of the association is the establishing of a freight bureau for its members. With the increasing c. i. f. sales in Sweden, many exporters, especially the smaller ones, have lost a great deal of money on the chartering of vessels because they were not always in a position to follow the freight market. Only the largest mills can afford to maintain a chartering and shipping department. Many mills are located at a great distance from the principal shipping centers and often it is difficult for them to keep posted as to freights, etc. Usually, therefore, the mills have been more or less in the hands of the steamship owners.

In order to remedy this condition, the association established a chartering bureau in 1915. The object of this bureau was to keep the association members informed regarding the freight market and to enable them to form their own opinion in regard to the tonnage question. It was first intended to operate merely as an information bureau, but later, the bureau's activities were extended to the chartering of tonnage for association members. From time to time, the exporters turn in to the bureau reports regarding their future

tonnage requirements, and these enable the bureau to work to better advantage.

The bureau does not speculate in freights, and tonnage is chartered only when it is needed. Opinions differed a great deal at the start regarding the usefulness of such an organization, but the association members now seem to be very well satisfied with the results. The cost of maintaining this service is borne by the association members through a small membership fee based on a fraction of 1 cent per 1,000 feet of the total shipments of the various mills during normal years and a small commission per ton of chartered space.

INFORMATION SERVICE.

One of the most successful and most important activities of the association is its information service. It is difficult to find exporters better posted on conditions in the importing countries than the Swedish lumber exporters. Aside from the fact that many of these exporters themselves have spent considerable time abroad working in various lumber offices and have frequently traveled in the principal importing countries in Europe, they are constantly kept posted through the association with regard to events in the lumber world.

The association publishes a confidential magazine, by which its members are kept informed regarding market conditions, prices, stock needed, etc., for different countries, the data being supplied by regular correspondents all over the world. Very full information is given in this way, both in regard to the matters directly affecting the Swedish exporters and also in regard to the activities of the other principal lumber-exporting countries. Information from Swedish Government officials abroad is also incorporated in these reports. The Swedish lumber exporters fully understand the value of this publication, as the Swedish papers in general contain only limited information in regard to market reports, etc.

The association has also taken up the work of compiling statistics. Data are gathered from all parts of the world concerning imports and exports of lumber, and special attention is given to the other north European lumber-exporting countries. Complete import statistics for every market are also prepared, so that the members at all times can follow the development of their own business, as well as that of the other lumber-exporting countries. The association's statistics are probably unequaled.

The association also warns Swedish exporters against dishonest importers and agents. Therefore a questionable deal may be made by an agent or importer once, but hardly twice.

The information service is not confined to conditions affecting the lumber export trade in foreign countries. The technical problems in regard to sawmill machinery, etc., are occasionally taken up in the confidential publication, but this service has not yet been fully developed. The district offices all report to the head office and these reports are published in the magazine. Such information contains reports on forest operations, floating, sawing, exporting, labor supply and demand, etc. The association also published statistics regarding stocks on hand and sales made in Finland, Russia, Norway, and Sweden.

These are the principal items covered in the confidential publication. All of it is considered confidential and is reserved for members. Very little information is given out to the press. A branch of the information service, however, is devoted to press campaigns, which are carried on by the association when questions arise that are of vital importance to its members, in regard to legislation, transportation, taxes, tariffs, etc.

COOPERATION WITH GOVERNMENT AND WITH OTHER ASSOCIATIONS.

The association's influence in official circles is considerable and it is looked upon almost as a semiofficial institution. It receives liberal support from the Swedish Government in many ways, as the success of the lumber export trade, which affects the whole nation's welfare, is thought by many to be dependent mainly upon this organization. There are no antitrust laws in Sweden and price fixing is not contrary to the law. If the exporters operate successfully, the revenue of the Government in the form of taxes increases correspondingly.

During the last years before the war an important step was taken by the Swedish association in seeking the cooperation of other associations in northern and eastern Europe. Especially with the Finnish association, the Swedish association has established very close connection and the newly reorganized association in Finland is modeled after the Swedish association. The Swedish association is also cooperating with the association in Norway; but as Norway exports mainly planed lumber and the conditions in general are somewhat different from those in Sweden, the need for close cooperation with this country is not so pressing. With Russian lumber associations a similar plan of cooperation was started before the war, but this work did not lead up to any tangible results on account of the lack of organization among the lumber exporters in Russia. Renewed efforts are contemplated, however, when order is restored in that country. The Finnish, Norwegian, and Swedish associations and a few local Russian associations exchange reports concerning stocks on hand, prices, and sales made.

ADVANTAGE OF SIMILAR ORGANIZATION FOR UNITED STATES.

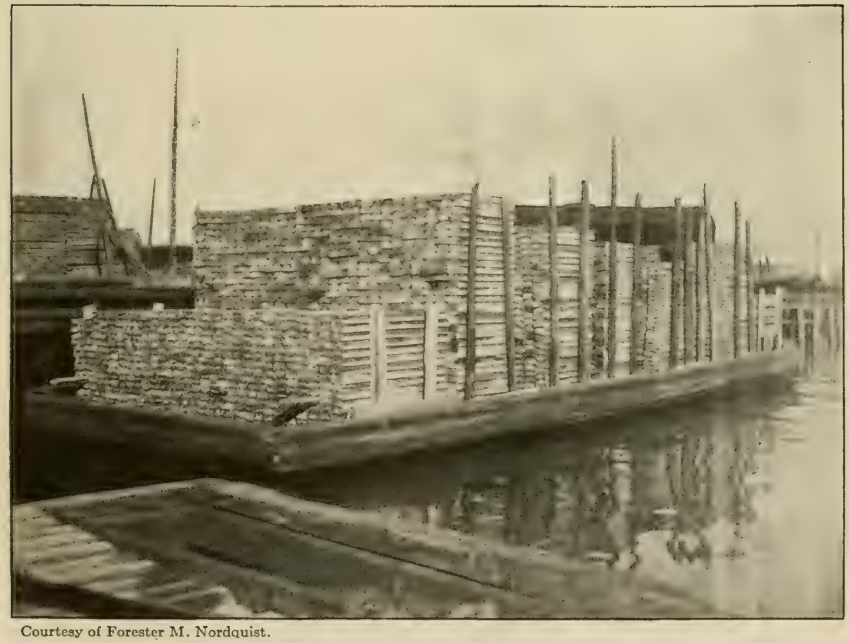
It would be of great benefit to establish a lumber exporters' association in the United States, to take up several of the activities in which the Swedish association is engaged. Leaving the price-fixing question out of consideration, an association of exporters in this country could offer valuable service to both exporters and importers by establishing uniform sales contracts, arbitration service abroad, a chartering bureau, etc., and could also disseminate information among American exporters regarding market conditions abroad.

TERMS OF PAYMENT AND FINANCING OF LUMBER EXPORT TRADE.

Considering the heavy investments that most of the Swedish sawmill plants and forest operations represent and the length of time that the operators usually must wait for their money from the time the timber is cut until it is manufactured and ready for shipment, it would not be possible in most cases for them to grant long credits

Courtesy of Forester M. Nordquist.

FIG. 105.—MINE PROPS IN PORT OF GOTEBORG.



Courtesy of Forester M. Nordquist.

FIG. 106.—TIES IN PORT OF GOTEBORG.

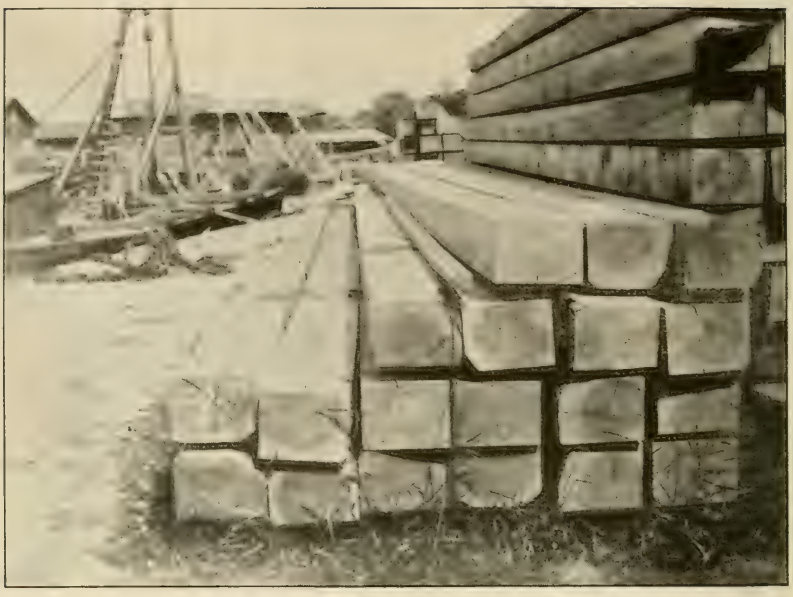


FIG. 107.—SQUARE TIMBER, ISLAND OF GOTLAND.

Courtesy of Refarnut A/B.

FIG. 103.—THE FIRST REFANUT LUMBER RAFT, CARRYING ABOUT 4,000,000 FEET BOARD MEASURE.

to importers. The cases where the exporters in Sweden carried the importers for any length of time were rare. The financing of the lumber export trade therefore, had been left to a large extent to banks or agents. It is an erroneous impression which has prevailed that the Swedish exporters were able to extend their markets abroad, mainly because they themselves granted long credits.

During the war, many changes were made in the methods of paying for lumber shipments; but as developments since the armistice have shown that Swedish shippers are doing business on practically the same basis as before the war in regard to conditions of payment, it is more important to give attention to pre-war conditions than to the many stipulations with regard to payment that were dictated by abnormal conditions during the war.

Before the war, the usual terms of payment in connection with the exportation of lumber were the following: Cash with order, less discount; open credit; cash against documents, less discount; draft at sight or at stated time after date of bill of lading.

Only in case of shipments to new markets such as the Levant, and to unknown customers was cash required with order. It was customary to require an unknown purchaser to open a confirmed, irrevocable bank credit in favor of the exporter at one of the principal financial centers in Europe, so that the exporter could obtain payment by drawing a draft against this credit, when the shipment had been made.

The open credit was not used very often.

By far the most common way of arranging for the payment of lumber for export was the drawing of drafts, either upon the importers direct or on the agent, who in turn could make special terms with the importers. The usual procedure was as follows: As soon as the ship was loaded, the exporter would draw a draft on the importer and, if the terms were cash, the draft was made payable at sight, less a stated discount of 2 per cent or 2½ per cent, as the case might be. Where credit was to be given, the draft was made payable three to four months from the date of the bill of lading. This draft was drawn in duplicate. The first of exchange, together with the shipping documents, was usually sent to the shipper's agent who sold the cargo and this agent immediately presented it to the importer for his acceptance: As soon as the draft was accepted it was returned by the importer to the agent in exchange for shipping documents. If the cargo was sold f. o. b. Swedish port, the documents would be bill of lading indorsed in blank by the shipper, invoice, and specifications; and if sold c. i. f., insurance policy and charter party would also be included. Consular invoices also must sometimes be furnished by the shippers.

When cargoes were sold on a c. i. f. basis, two drafts were generally drawn by the exporter, one payable at sight, covering freight and insurance, and the other at three to four months from date of bill of lading, covering the amount of the invoice for the lumber shipment alone. Only with the bill of lading in his possession would the importer be able to prove himself the rightful receiver of the cargo. The first of exchange, carrying the importer's acceptance, would then be kept by the agent and presented for collection on the date when the draft fell due.

In case the exporter should want to discount the draft, he would sell the second of exchange to a local bank; the bank would then present the second of exchange at the agent's office and would obtain the first of exchange duly accepted. The bank would thereupon attend to the collection itself. The agents generally did not charge any commission for their service, while a bank made a small charge for cashing this document. In cases where shippers have advanced money to the captain on the freight, a sight draft is drawn for this amount.

In some cases, the agent would guarantee the solvency of the customer to whom he had sold (del credere) and would receive a commission, usually one-half to 1 per cent, for such services. Through special arrangement the exporter in many cases could draw a draft on the agent for the amount of the invoice, less agent's commission, and the agent, in turn, would draw on the importer, with whom he could make special conditions in regard to terms of payment. Many of the large agencies abroad maintained banking departments, but other agencies of less financial resources would make arrangements with their banks to discount the drafts drawn by them on the importers. In this latter way, it was not necessary for the agents to operate with large capital. Many agents, however, practically financed the importers and in this way were enabled to effect many sales for the exporter in cases where the exporter himself would not be willing to give long credit. It is also certain that the agents who financed the importers in this way were often able to exercise an important influence on the importers known to make unjust claims.

The terms of payment vary considerably in the different countries. In dealings with the United Kingdom, the usual terms were cash, 3 days after sight, less 2½ per cent discount, or draft payable 4 months after date of bill of lading. Contracts made with British colonial markets usually called for payment in London, 3 days after sight, less 2½ per cent discount. In some cases credit of 4 months after date of bill of lading was granted. The terms of contracts for shipments to France and Belgium were generally cash, less 2½ per cent discount, or 10 days after sight, less 2 per cent, or draft payable 4 months after date of bill of lading. Special conditions cover the German market. The usual terms of payment were cash 3 days after sight, less 2 per cent discount, or cash 10 days after date of bill of lading, less 2 per cent discount, or draft payable 3 to 4 months after date of bill of lading. The condition of payment for the Netherlands and Denmark were generally drafts payable 3 to 4 months from date of bill of lading or cash, less 2 per cent discount. Spanish importers usually paid cash, less 2½ per cent discount, or by draft payable in London, 4 months after date of bill of lading. In some cases, particularly in southern Spain, longer credits were granted. For the Levant and North Africa, the exporters usually demanded bankers' confirmed credit in London, less 2½ per cent discount; or, in case of well-known customers, drafts were made payable 4 months after date of bill of lading. The Swedish Exporters' Association endeavors to have cash discount limited to 2 per cent for all countries.

It is easily seen that the agents of the Swedish shippers perform a very valuable service in the financing of the lumber export trade when the shippers themselves are unable to grant the necessary credit. Many importers whose reputation and standing would be

considered satisfactory might not be able to purchase an entire cargo if credit were not given. The agent also ascertains the financial standing of the importer before he makes a sale, even in cases where he does not assume any financial responsibility for his client. It must be noted, however, that the Swedish exporters always draw on their agents for the full amount of the invoice, less the agent's commission. To be able to draw for only a certain percentage of the invoice (not including agent's commission) would not be considered unless the exporter were notoriously unreliable, and no first-class agent would care to handle such business. The Swedish exporters operate on a financially strong basis and do not take on uncertain customers, and the agents also have the situation well in hand. Therefore the losses sustained by Swedish exporters on account of bad debts are almost negligible.

In regard to payment in special cases when delivery is not according to contract, etc., see contract form on pages 223 to 225.

The policy of the Swedish exporters in the near future will be to grant no credit to foreign importers.

STANDARDS OF MEASURE.

Although the metric system of measurement is compulsory by law, it is not universally used in Sweden in the lumber trade, because the most important markets for Swedish lumber employ the English system of measurement. In official statistics the metric measurement is used. There is no question that the metric measurement is far more adequate and scientific and there is a strong movement in Sweden to have it adopted universally in the lumber trade.

The cubic meter is equal to 35.314 cubic feet and a cubic meter of sawn lumber is equal to 424 board feet. In the international lumber trade, Swedish lumber is sold by the Petrograd standard, which is equal to 165 cubic feet, 4.67 cubic meters, or 1,980 board feet. The above figures refer to rough lumber. In measuring planed lumber the actual sizes of the planed boards are increased by one-fourth of an inch in width and one-eighth of an inch in thickness; this measure is called nominal measure and is made the basis of the measurements of the contents of planed boards. The planed lumber is also usually measured in Petrograd standards, but sometimes the measurements are given in square meters, square feet, etc. It must be noted, however, that lumber less than 1 inch in thickness is always figured at its actual measurement (adding $\frac{1}{4}$ of an inch to the width and $\frac{1}{8}$ of an inch to the thickness), and not by surface measure, as is the custom in other countries.

In regard to logs and hewn or sawn timber, the methods of measurement are very conflicting, some basing the measurement on top measurement and in other cases on the diameter of each log at the middle. The quantities are expressed in cubic feet, cubic meters, or Petrograd standards. One Petrograd standard of hewn timber is equal to 150 cubic feet. One Petrograd standard of round logs is equal to 120 cubic feet if measured by caliper and 100 cubic feet if measured by string. Pit props and split wood are usually measured by the cubic fathom, equal to 216 cubic feet.

RATES OF EXCHANGE.

It was customary in the Swedish lumber export trade before the war to make quotations in foreign money. In selling to the United Kingdom and colonies and to some other countries quotations have usually been made in pounds sterling, to Germany in German marks, to France in francs, etc. This was possible before the war without any great risk caused by fluctuations in the rate of exchange, because the rates were fairly constant from one month to another. During the war the heavy fluctuations caused the Swedish lumber exporters to establish a fixed rate of exchange to which they all adhered. These fixed rates were as follows: £1 sterling, 18.20 crowns (par value, 18.16 crowns); 100 francs, 72 crowns (par value, 72 crowns); 100 German marks, 89 crowns (par value, 88.89 crowns); 100 guilders, 150 crowns (par value, 150 crowns). By this procedure the Swedish exporters prevented any unforeseen losses through fluctuations in the rate of exchange and it did not make any difference whether the quotations were in foreign or in Swedish money. The exporter always knew the exact amount that he would receive in Swedish money. This system is followed at the present time and will probably continue as long as the rate of exchange is abnormal in most of the importing countries. [In this report the par value of Swedish money has been used.]

The following statement shows the fluctuation in the rate of exchange of the Swedish crown from 1914 to 1919 on London, Paris, and New York. The rate on London is in crowns per pound sterling; on Paris, in crowns per 100 francs; and on New York, in crowns per dollar.

Years.	London.		Paris.		New York.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1914	19.19	18.18	77.45	72.16	3.97	3.75
1915	19.43	16.97	77.60	61.64	4.05	3.60
1916	17.27	15.66	62.04	55.51	3.63	3.312
1917	16.16	12.02	58.28	44.18	3.414	2.548
1918	16.90	13.40	65.28	49.48	3.57	2.82
1919	18.08	16.56	65.33	48.48	4.10	3.49

PRICES.

The price level of lumber for export from Sweden fluctuated to some extent during the last 50 years before the war. The variations in prices have been especially noticeable after important wars, such as the Franco-Prussian War and the Boer War, etc. Shortly after the Franco-Prussian War Swedish lumber prices advanced about 100 per cent. The price in 1874 covering rough and planed lumber was as high as $23 per 1,000 feet board measure. After that time there was a sharp decline and in 1879 the price came down to about $13. A further decline was experienced in the following years, and in 1886 the ebb was reached with a price of $12 per 1,000 feet. After 1886 the prices increased, with some interruptions, until 1913, and the price for this year, about $20, represented the highest since 1875. In 1914 the price level was somewhat lower, but during the war the prices increased and are at present about three times as high as the

pre-war level. These abnormal prices must be attributed to the great demand for lumber in foreign countries, the limited supply from other exporting countries, and the high cost of stumpage and labor in Sweden.

At present (November, 1919) prices have not shown any tendency to decline. On the contrary, one may expect higher prices in the future, as the demand will probably increase and it will take considerable time before Russia, which was the largest lumber-producing country in Europe, will be enabled to export such large quantities as it did before the war. Furthermore, competition among the northern European exporters has been regulated to some extent, and the importers may not count on playing one exporter against another, at least not in connection with exporters in northern Europe.

Except on the west coast, it has not generally been the custom in Sweden to sell on a c. i. f. basis; that is, the mills have not generally undertaken delivery of the lumber at the port of destination and have not included charges for freight and insurance in their quotations. However, some mills have been in a better position than others to sell on a c. i. f. basis, as before the war a few mills in Sweden possessed their own tonnage. During the war several other Swedish mills either have acquired ships or have obtained a financial interest in shipping companies. It is believed that increased c. i. f. sales will be the consequence in the future and that more mills will have their own tonnage.

BASIS OF PRICE QUOTATIONS.

For many years it has been customary in Sweden to base quotations on the prices obtained by the district of Hernosand. The corresponding prices for the other districts are figured by applying the customary difference in prices between the different shipping districts and those of the Hernosand district.

Before the war there were no absolutely fixed relations among the prices obtained by the different districts, but this question was settled in 1918, when the Swedish lumber exporters through their association established fixed minimum prices for each district. The prices in different districts may fluctuate to some extent, as they are dependent largely upon freight rates.

The following schedule gives the customary difference in the f. o. b. prices per 1,000 feet board measure between the principal shipping ports in Sweden and the Hernosand district, which is taken as the basis:

Ornskoldsvik	$0.31 below basis.
Umea	$0.92 below basis.
Skelleftea and Pitea	$1.84 below basis.
Lulea and Haparanda	$2.46 below basis.
Sundsvall	$0.61 above basis.
Hudiksvall and Soderhamn	$1.23 above basis.
Gevle and Stockholm	$1.54 above basis.
Ports south of Stockholm	$2.46 above basis.[2]
Goteborg	Even up to $5 above basis.

[2] During winter season.

It is impossible to give any general statement as to the relative value of spruce and pine lumber. Spruce was formerly sold at a heavy discount, but later the difference in price between spruce and pine decreased materially, so that immediately before the war spruce was selling for approximately 10 per cent less than pine. This statement does not hold good for all dimensions; certain dimensions of spruce were sold at the same price as pine, while other dimensions were sold at a heavier discount than 10 per cent. During the war the production of spruce in Europe materially decreased and spruce has therefore advanced in price more than pine. The main reason for this spruce shortage was the lack of exports during the war from Russia, one of the world's sources for this material. Furthermore, the pulp factories consumed large quantities of spruce logs, because this species is more suitable for pulp than pine. At present spruce and pine are generally sold at the same price, but certain stocks of spruce may be sold at a premium.

In the price scales covering the different dimensions considerable variations have been experienced in years past. Considering that Swedish exporters can furnish only limited quantities of wide stock, such stocks have naturally been sold at a higher price than the stocks of which there is an ample supply, such as narrow boards. As the Swedish stock lists may contain as many as 600 different items, it is evident that a price scale must be used in order to enable the importers to estimate the cost of the different items without having special quotations for each. Before the war the price scales used in Sweden were not definitely fixed, as the demand from one year to another would vary considerably, and also the demand for certain stocks in the different countries.

It was customary to select three or four of the principal dimensions, one for each of the following groups: Planks, battens (or scantlings), and boards (or narrow boards). The relative prices of these three groups were usually not fixed but the prices of the different dimensions of each group generally had a certain relation to each other. The usual basic dimensions for which quotations were made were as follows: 3 by 9 inches, 2½ by 7 inches, 2 by 4 inches, and 1 by 4½ inches; but other dimensions were sometimes given.

During the war, with the fixing of minimum prices, the question of a definite price scale was also settled. Some variations have been made in the present schedules, compared with the pre-war schedules, particularly with respect to the value of planks and wide boards. Again, the decreased output of Russian stock, which contains a large percentage of wide sizes, has had its important influence on the market.

It must be understood, however, that the scale of prices is not absolutely definite because the exporter may deviate at times from the rules laid down by the association. Such deviations are dictated by unusual conditions, such as specifications containing excess quantities of any one dimension of regular stock sizes, which would at times cause extra prices, or an order calling for a large quantity of undesirable stock, which the exporter may be forced to sell at a special discount in order to dispose of this material. Such cases, however, are referred to the association, if important.

The question of grading enters into consideration in connection with the relative prices of shipments from different districts; but for practical purposes the grading of lumber in Sweden may be considered

fairly uniform and it would require a detailed knowledge of conditions in the different districts to ascertain what effect the different systems of grading would have on the prices. In some cases the least satisfactory products may be sold at $1.23 to $1.84 per 1,000 feet below the prices obtained by the standard products in the same territory and in other cases the difference in price may be larger. Certain exporters have even been able to obtain $2.45 per 1,000 feet in excess of the prices obtained by other shippers in the same district, because their brands were well established in certain countries.

Considering the different prices obtained by the various districts in Sweden, due consideration must be given to the question of freights and shipping facilities. For instance, the ports in northern Norrland, having only a short shipping season, must be somewhat rushed in disposing of their lumber, while the shippers on the west coast of Sweden can take their time in selling, because they are able to ship the year round. The same conditions apply to the shipping districts south of Stockholm. Although the Stockholm–Malmo district is usually known to have poorer-quality lumber in comparison with the Norrland districts, the shippers in the Stockholm–Malmo district may obtain $0.61 to about $2.50 more than the shippers in the Norrland districts during the season when these latter shippers are unable to export their stock. During the summer months, however, the prices obtained by shippers in the Stockholm–Malmo district materially decrease on account of the competition with the shippers farther north. The lumber from the west-coast districts is sold at best advantage during the winter months. Lumber shipped from the port of Goteborg usually obtains very high prices on account of the excellent shipping facilities which this port offers, having direct steamship connections with most of the foreign markets for Swedish lumber. Consequently the shippers in this port can make immediate deliveries and also ship in parcel lots. An increase of even $5 per 1,000 feet above the price obtained from the shippers in the Norrland districts is not unusual during the winter months on the west coast of Sweden' but these high prices refer only to the output of standard mills. The higher the freight rates the greater the difference in the price of lumber from the west coast and from the Norrland ports.

The prices are usually quoted on an average-length basis; counting lumber 9 feet and up. Short lumber (6, 7, and 8 feet) is generally included in the cargo up to 5 per cent of the total quantity and is sold at two-thirds of the regular price. Sometimes 9, 10, and 11 foot lumber is sold separately, and this stock is usually sold at three-fourths of the regular price. If specified lengths are ordered, the prices may be increased by $5 to $7.50 per 1,000 feet board measure. Orders from South Africa generally specify that no lumber less than 10 feet long shall be shipped and also that a certain percentage of the cargo shall consist of lumber at least 20 feet long. For lumber conforming to these specifications an extra charge of $5 to $7.50 per 1,000 feet board measure is generally made.

Rift-grain lumber is produced only by a few companies and in very limited quantities. One hundred per cent and more extra is charged for such stock. The same applies to heart specifications, for which there is no definite price schedule. If the exporter understands that the importer must have such stock, he may charge almost any price.

It has been found unprofitable to cater to this trade, however, as many claims result from sales of such special stock.

In cutting extra sizes and odd stock it is usually specified that the customer shall take either all grades or at least a certain percentage of the log run at a certain reduction. Contracts of this nature generally call for lumber of unsorted grade and the conditions generally are that at least 20 to 25 per cent of the fifth grade must be taken at current prices. When quoting for odd sizes the mills ascertain from what log dimensions they must produce such lumber. They charge not only for extra handling but also for waste of material in sawing; for instance, if orders call for stock 6¾-inches wide, the prices would have to be based on 7-inch width, in addition to a charge of $1.23 to $1.84 per 1,000 feet, board measure, for extra handling.

Some countries, especially Denmark and the Netherlands often specify many items containing only a few thousand feet each. Evidently making up such cargoes causes the exporters a great deal of trouble, and extra charges have usually been made, ranging from $1.23 to $2.46 per 1,000 feet for quantities less than 10,000 feet board measure of any one dimension shipped.

PRICES AT HERNOSAND FROM 1910 TO 1919.

The following statement gives the average prices from 1910 to 1918 of some of the principal dimensions at first open water (f. o. w.; lumber sold during the previous winter and autumn), f. o. b. Hernosand. The prices are based on the usual average lengths.

1910.	Per M feet.
3 by 9 inch pine:	
First grade	$41.48
Second grade	36.56
Third grade	27.34
Fourth grade	24.89
Fifth grade	21.51
3 by 9 inch spruce:	
First grade	25.88
Second grade	24.32
Third grade	22.74
Fourth grade	21.17
Fifth grade	19.61
2½ by 7 inch pine, unsorted grade	21.20
2 by 4 inch pine, unsorted grade	19.05
2 by 4 inch spruce, unsorted grade	17.20
Pine boards, unsorted grade:	
9-inch	28.26
8-inch	23.35
7-inch	22.74
6-inch	21.51
5-inch	20.28
4½-inch	19.97
4-inch	19.05
Spruce boards, unsorted grade:	
9-inch	21.63
8-inch	20.43
7-inch	19.83
6-inch	19.23
5-inch	18.63
4½-inch	18.03
4-inch	17.43

1911.	Per M feet.
3 by 9 inch pine:	
First grade	$41.48
Second grade	36.56
Third grade	27.34
Fourth grade	24.89
Fifth grade	21.51
3 by 9 inch spruce:	
First grade	25.10
Second grade	46.84
Third grade	21.95
Fourth grade	20.39
Fifth grade	18.82
2½ by 7 inch pine, unsorted grade	21.20
2½ by 7 inch spruce, unsorted grade	19.36
2 by 4 inch pine, unsorted grade	19.05
2 by 4 inch spruce, unsorted grade	17.20
Pine boards, unsorted grade:	
9-inch	28.26
8-inch	23.35
7-inch	22.74
6-inch	21.51
5-inch	20.28
4½-inch	19.97
4-inch	19.05
Spruce boards, unsorted grade:	
9-inch	21.63
8-inch	20.43
7-inch	19.83
6-inch	19.23
5-inch	18.63
4½-inch	18.03
4-inch	17.43

1912.	Per M feet.
3 by 9 inch pine:	
First grade	$38.10
Second grade	33.18
Third grade	24.42
Fourth grade	21.96
Fifth grade	19.51
3 by 9 inch spruce:	
First grade	23.93
Second grade	22.35
Third grade	20.78
Fourth grade	19.21
Fifth grade	17.65
2½ by 7 inch pine, unsorted grade	20.28
2½ by 7 inch spruce, unsorted grade	18.74
2 by 4 inch pine, unsorted grade	18.13
2 by 4 inch spruce, unsorted grade	16.59
Pine boards, unsorted grade:	
9-inch	25.81
8-inch	22.12
7-inch	21.51
6-inch	20.28
5-inch	19.05
4½-inch	18.74
4-inch	17.82
Spruce boards, unsorted grade:	
9-inch	21.23
8-inch	19.03
7-inch	19.83
6-inch	18.63
5-inch	18.03
4½-inch	17.43
4-inch	16.83

1913.	
3 by 9 inch pine:	
First grade	39.02
Second grade	34.10
Third grade	26.42
Fourth grade	23.96
Fifth grade	21.96
3 by 9 inch spruce:	
First grade	27.06
Second grade	25.49
Third grade	23.93
Fourth grade	22.35
Fifth grade	20.78
2½ by 7 inch pine, unsorted grade	21.96
2½ by 7 inch spruce, unsorted grade	20.58
2 by 4 inch pine, unsorted grade	19.66
2 by 4 inch spruce, unsorted grade	18.43
Pine boards, unsorted grade:	
9-inch	28.26
8-inch	24.58
7-inch	23.04
6-inch	21.81
5-inch	21.28
4½-inch	20.58
4-inch	19.51
Spruce boards, unsorted grade:	
9-inch	$22.24
8-inch	21.03
7-inch	20.73
6-inch	20.13
5-inch	19.53
4½-inch	18.63

1914.	
3 by 9 inch pine:	
First grade	39.02
Second grade	34.10
Third grade	27.80
Fourth grade	25.35
Fifth grade	22.43
3 by 9 inch spruce:	
First grade	29.02
Second grade	27.45
Third grade	25.88
Fourth grade	24.32
Fifth grade	22.74
2½ by 7 inch pine, unsorted grade	23.04
2½ by 7 inch spruce, unsorted grade	21.51
2 by 4 inch pine, unsorted grade	20.89
2 by 4 inch spruce, unsorted grade	19.36
Pine boards, unsorted grade:	
9-inch	27.96
8-inch	24.27
7-inch	23.66
6-inch	22.43
Spruce boards, unsorted grade:	
9-inch	23.44
8-inch	22.24
7-inch	21.33
6-inch	20.73
5-inch	20.13
4½-inch	20.26
4-inch	19.29
Cull stock:	
2 inches and thicker	15.67
Less than 2 inches thick	14.44

1915.	
3 by 9 inch pine:	
First grade	39.33
Second grade	35.64
Third grade	29.49
Fourth grade	27.04
Fifth grade	24.58
3 by 9 inch spruce:	
First grade	28.23
Second grade	26.66
Third grade	25.10
Fourth grade	46.84
Fifth grade	21.95
2½ by 7 inch pine, unsorted grade	25.81
2½ by 7 inch spruce, unsorted grade	25.19
2 by 4 inch pine, unsorted grade	22.74
2 by 4 inch spruce, unsorted grade	22.12

	Per M feet.
Pine boards, unsorted grade:	
9-inch	$28.55
8-inch	27.34
7-inch	26.44
6-inch	25.19
5-inch	24.64
4½-inch	21.81
4-inch	20.58
Spruce boards, unsorted grade:	
9-inch	28.26
8-inch	26.11
7-inch	25.50
6-inch	24.89
5-inch	24.27
4½-inch	21.20
4-inch	19.97
Cull stock:	
2 inches and thicker	17.82
Less than 2 inches thick	15.02

1916.

3 by 9 inch pine:	
First grade	43.93
Second grade	39.02
Third grade	38.10
Fourth grade	35.64
Fifth grade	32.71
3 by 9 inch spruce:	
First grade	40.80
Second grade	39.25
Third grade	37.85
Fourth grade	36.07
Fifth grade	34.40
3 by 8 inch pine, unsorted grade	34.72
3 by 8 inch spruce, unsorted grade	36.56
2½ by 7 inch pine, unsorted grade	33.64
2½ by 7 inch spruce, unsorted grade	35.18
2 by 7 inch pine, unsorted grade	35.02
2 by 7 inch spruce, unsorted grade	35.18
2 by 6 inch pine, unsorted grade	33.80
2 by 6 inch spruce, unsorted grade	34.10
2 by 5½, 5, 4½, and 4 inch pine, unsorted grade	32.57
2 by 5½ and 5 inch spruce, unsorted grade	33.80
2 by 4½ and 4 inch spruce, unsorted grade	32.71
7-inch boards, pine, unsorted grade	34.72
7-inch boards, spruce, unsorted grade	35.18
4½-inch boards, pine, unsorted grade	29.19
4½-inch boards, spruce, unsorted grade	29.19
4-inch boards, pine, unsorted grade	28.26
4-inch boards, spruce, unsorted grade	28.26
Cull stock:	
2 inches and thicker	25.19
Less than 2 inches thick	24.58

1917.

3 by 9 inch pine, unsorted grade	39.94
3 by 9 inch spruce, unsorted grade	39.94
2½ by 7 inch pine, unsorted grade	33.80
2½ by 7 inch spruce, unsorted grade	35.64
2 by 4 inch pine, unsorted grade	33.80
2 by 4 inch spruce, unsorted grade	34.41
7-inch boards, pine, unsorted grade	35.64
7-inch boards, spruce, unsorted grade	35.64
4-inch boards, pine, unsorted grade	30.11
4-inch boards, spruce, unsorted grade	30.11
Cull stock:	
2 inches and thicker	25.87
Less than 2 inches thick	25.19

1918.

Pine and spruce, unsorted grade:	
9-inch planks and boards	45.16
8-inch battens and boards	43.32
7-inch battens and boards	41.78
6-inch battens and boards	41.17
5-inch battens and boards	40.55
4½-inch battens and boards	39.33
4-inch battens and boards	37.79
Cull stock:	
6 inches and wider	30.72
4–5½ inches wide	28.88

The following table gives the prices in 1919 per 1,000 feet board measure of different widths of pine and spruce planks, battens, scantlings, and boards, f. o. b. Hernosand, first open water:

Widths.	Planks, battens, scantlings.	Boards.	Widths.	Planks, battens, scantlings.	Boards.
	Per M feet.	*Per M feet.*		*Per M feet.*	*Per M feet.*
12 and 11 inches	$72.51	$73.73	6 inches	$54.07	$55.30
10 and 9 inches	60.22	61.45	5½ and 5 inches	52.23	54.07
8½ inches	57.76	57.76	4½ inches	52.23	52.84
8 inches	57.14	57.14	4 inches	52.23	52.23
7 and 6½ inches	55.30	55.30			

Cull stock 6 inches and more in width sold at $43.01 and less than 6 inches wide, at $41.78 per 1,000 feet.

OFFICIAL FIGURES FOR SPECIFIED DATES.

The following table shows the official figures for prices f. o. b. Hernosand in January, 1912 to 1919, and in September, 1919, of various sizes and grades of pine and spruce:

Months.	3 by 9 inch pine, third grade.	1 by 4½ inch pine, unsorted grade.	2½ by 7 inch spruce, unsorted grade.	Months.	3 by 9 inch pine, third grade.	1 by 4½ inch pine, unsorted grade.	2½ by 7 inch spruce, unsorted grade.
	Per M feet.	*Per M feet.*	*Per M feet.*		*Per M feet.*	*Per M feet.*	*Per M feet.*
January, 1912	$24.37	$18.76	$18.76	January, 1917	$47.76	$38.01	$43.37
January, 1913	26.33	20.23	19.98	January, 1918	45.81	37.52	40.94
January, 1914	27.29	20.47	21.44	January, 1919	61.40	54.09	56.53
January, 1915	28.26	20.71	23.39	September, 1919	66.28	55.07	58.48
January, 1916	36.06	28.26	32.65				

The following table shows the official figures for the average export prices of Swedish pine and spruce, rough and planed, from 1902 to 1918:

Years.	Pine.		Spruce.	
	Rough stock.	Planed stock.	Rough stock.	Planed stock.
	Per M feet.	*Per M feet.*	*Per M feet.*	*Per M feet.*
1902	$17.74	$19.22	$13.98	$17.02
1903	20.03	20.50	15.86	19.23
1904	17.17	19.22	14.44	17.80
1905	17.24	19.29	14.75	17.81
1906	19.50	21.03	17.12	19.08
1907	21.97	22.03	18.09	20.52
1908	18.52	19.27	15.56	18.25
1909	20.12	22.22	17.33	20.38
1910	21.70	23.65	18.44	22.18
1911	20.64	22.79	17.72	21.70
1912	18.97	21.31	16.95	20.50
1913	20.30	23.00	18.12	22.85
1914	20.97	22.87	20.40	23.37
1915	23.55	24.93	22.94	25.50
1916	31.51	32.78	31.30	33.09
1917	40.23	40.22	38.52	39.15
1918	44.92	47.27	43.57	47.27

The following table gives the average export values of lumber, planed and rough, for 1913, 1914, 1915, and 1916, according to Swedish export statistics:

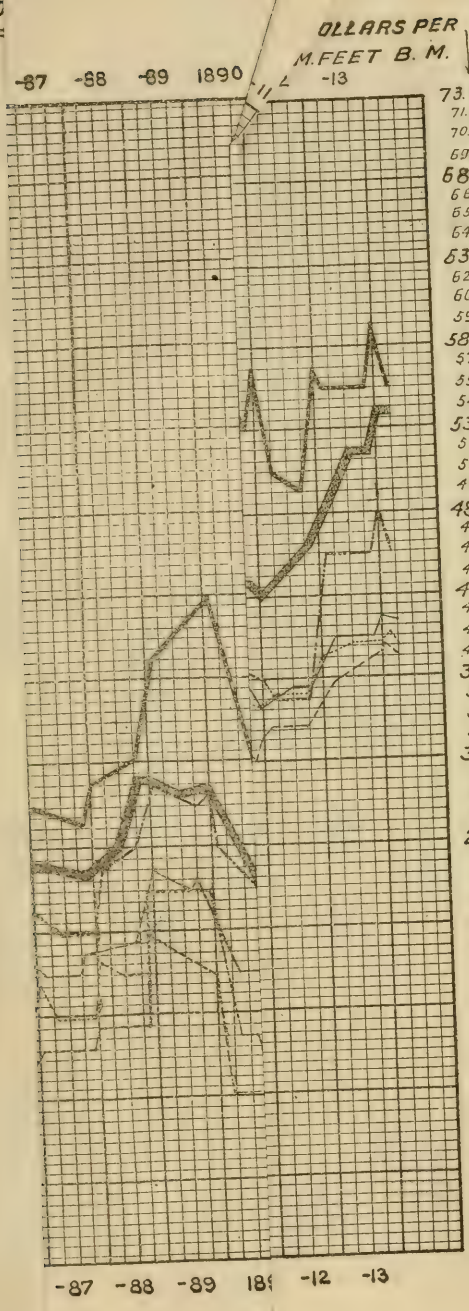
Kinds of wood.	1913	1914	1915	1916
Planks:	*Per M feet.*	*Per M feet.*	*Per M feet.*	*Per M feet.*
Pine	$23.70	$24.15	$27.45	$36.00
Spruce	21.30	22.25	26.70	35.75
Battens:				
Pine	19.70	20.55	24.15	32.50
Spruce	18.75	20.60	23.70	32.35
Scantlings:				
Pine	17.25	19.80	23.75	31.15
Spruce	16.95	19.00	22.65	30.75
Boards, 8½ inches up:				
Pine	26.30	23.65	25.55	32.30
Spruce	22.10	20.90	23.80	31.95
Boards, 6 to 8½ inches wide:				
Pine	22.00	21.90	23.85	30.00
Spruce	19.00	20.40	22.90	30.85
Boards, less than 6 inches wide:				
Pine	16.45	18.00	19.95	26.05
Spruce	16.00	17.70	19.85	26.20
Planed boards, 8½ inches up:				
Pine	29.75	26.45	28.50	34.80
Spruce	26.40	28.10	30.30	38.30
Planed boards, 6 to 8½ inches wide:				
Pine	23.65	23.70	26.35	34.70
Spruce	23.00	23.50	26.40	34.55
Planed boards less than 6 inches wide:				
Pine	20.95	21.20	23.10	30.85
Spruce	21.65	21.85	23.35	31.00

REVIEW OF PRICES FROM 1870 TO 1901.

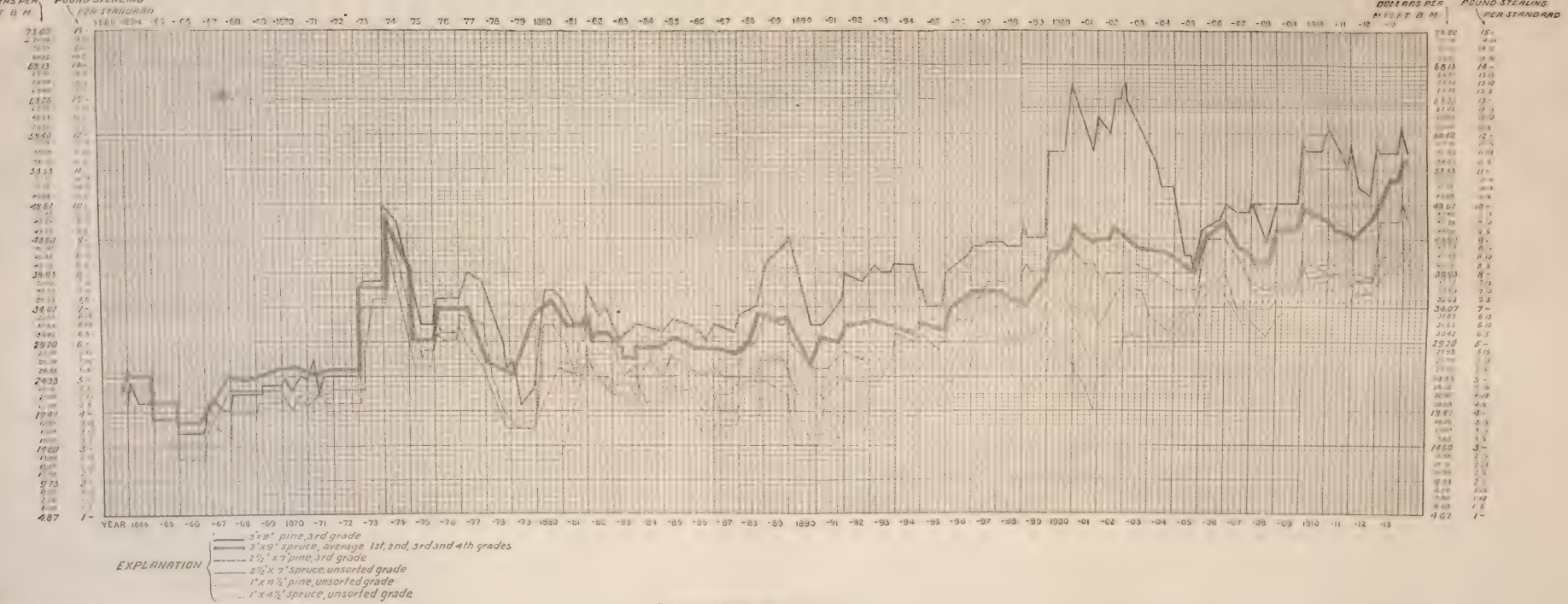
For years previous to 1902, as far as 1870, an average annual figure for the export prices of both pine and spruce, planed and rough, has been supplied by the Swedish Lumber Exporters' Association as follows:

	Per M feet.		Per M feet.		Per M feet.
1870	$13.20	1881	$16.70	1892	$14.00
1871	13.55	1882	16.70	1893	14.20
1872	16.60	1883	14.60	1894	14.70
1873	20.60	1884	14.50	1895	14.20
1874	23.35	1885	14.15	1896	14.80
1875	20.30	1886	11.90	1897	16.05
1876	19.90	1887	13.25	1898	16.65
1877	20.80	1888	14.20	1899	15.50
1878	14.90	1889	14.90	1900	16.90
1879	12.85	1890	13.78	1901	16.60
1880	16.90	1891	13.35		

The fluctuation in the pre-war prices of some of the principal dimensions for export is seen from figure 113, which is published through the courtesy of the Swedish Lumber Exporters' Association.



t prices of Swedish lumber,



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110, 109.—Export prices of Swedish timber, from 1864 to 1913.

PRICES AT CENTRAL NORRLAND PORTS.

The following table gives average export prices per 1,000 feet board measure, f.o.b. central Norrland ports, for various dimensions and grades of pine and spruce from 1914 to 1919:

Dimensions.	Grades.	1914	1915	1916	1917	1918	1919
3 by 9 inches:							
Pine	Third	$27.80	$29.49	$38.10	$39.94	$45.16	$60.22
Spruce	Average first, second, third, and fourth	26.73	25.95	38.55	39.94	45.16	60.22
2½ by 7 inches:							
Pine	Unsorted	23.04	25.80	33.64	33.80	41.78	55.30
Spruce	do	21.50	25.19	35.17	35.64	41.78	55.30
1 by 4½ inches:							
Pine	do	20.73	21.81	29.19	30.72	39.33	52.23
Spruce	do	20.28	21.20	29.19	30.72	39.33	52.23

The following table shows the quotations in the autumn of 1919 for different dimensions and grades of rough pine and spruce lumber, f.o.b. central Norrland ports, for shipment to the Netherlands and Germany:

Widths.	Planks, battens, and scantlings.		Boards.	
	Unsorted grade.	Fifth grade.	Unsorted grade.	Fifth grade.
	Per M feet.	*Per M feet.*	*Per M feet.*	*Per M feet.*
11 inches	$78.52	$68.34	$82.00	$68.34
10 inches	74.50	64.85	77.18	64.85
9 inches	70.48	64.85	73.16	64.85
8½ inches	67.80	63.52	69.14	63.52
8 inches	67.00	63.52	68.34	63.52
7 and 6½ inches	64.85	61.64	65.66	61.64
6 inches	64.32	60.84	64.85	60.84
5½ inches	64.05	60.57	64.59	60.57
5 inches	63.52	60.30	64.32	60.30
4½ inches	62.18	58.96	62.18	58.16
4 inches	61.64	58.16	61.64	57.62
3½ and 3 inches	60.84	57.62	58.96	54.94

For 1⅛ and ⅞ inch lumber by 3 to 11 inches, there was an additional charge of $2.04 per 1,000 feet board measure; and for three-fourths and five-eighths inch lumber by 6 inches and more, an additional charge of $1.35.

Following are quotations in the autumn of 1919 for different dimensions and grades of lumber, f. o. b. central Norrland ports, for shipment to South Africa, Australia, and British India: 3, 2½, and 2 by 9 inches, unsorted or third grade (pine or spruce), $78.65 per 1,000 feet board measure; 3, 2½, and 2 by 9 inches, fourth grade, $76.19; 3, 2½, and 2 by 9 inches, fifth grade, $73.73. These prices are based on an average length of 16 to 17 feet; there is an additional charge of $2.46 per 1,000 feet if the average length is 17 to 18 feet, and of $4.92 per 1,000 feet if the average length is 18 to 19 feet. If the average length is 15 to 16 feet, the price is $1.23 per 1,000 feet less

than the 16–17-foot basis. For a 15-foot average length the price was $66.36 per 1,000 feet for the following dimensions: 3, 2½, and 2 by 7 inches; 3, 2½, and 2 by 6 inches; 1½ by 6 inches; 3 by 5½ inches; 3 by 5 inches; 3 by 4½ inches; 1½ by 4½ inches; 2½ by 3 inches; 2 by 3 inches. If 14 to 15 feet is the average length, the price is $1.23 less per 1,000 feet.

The prices for planed lumber are based on the dimensions of rough stock from which the planed lumber is manufactured; for instance, planed lumber having an actual measurement of ⅞ by 3¾ inches would be priced as 1 by 4 inches. The fixed charges for planing would be added to the prices for rough stock. Before the war these fixed charges for planing were $1.84 to $2.46 per 1,000 feet board measure and during the war about $3.69 to $4.90.

When prices are quoted, the basis is made 1 by 7 inches plain edge (surfaced four sides), and extra charges are made for planing to different patterns. These extra charges for planing will no doubt be raised in the near future to correspond with revised price lists issued in Norway.

Planed lumber of pine or spruce (ceilings, including bundling with wire) was quoted as follows in the autumn of 1919, f. o. b. central Norrland ports, for shipment to South Africa: 6½ inch, tongued and grooved, colonial first grade, $71.28 per 1,000 feet board measure; 6½-inch tongued, grooved, and beaded, colonial first grade, $74.96. Colonial third is $2.46 per 1,000 feet less than colonial first grade, and unsorted grade is $0.61 per 1,000 feet less than colonial first grade. These prices are based on an average length of 15 to 16 feet. For an average of 16 to 17 feet, $2.46 is added to the basis and for an average of 14 to 15 feet, the price is $1.23 less than the basis. Five-inch stock is $1.23 less than 6½-inch stock.

The same prices apply to Australia and British India, but third grade is generally sold to Australia at $1.84 less than colonial first grade. The extra charges for planing are the same as those for the United Kingdom, but ⅝-inch stock commands $1.84 per 1,000 feet board measure extra for South Africa. For Australia the following extra charges apply: ¾-inch stock, $1.23 extra per 1,000 feet board measure; ⅝-inch stock and weatherboards, $2.46 extra; ½-inch stock, $3.69 extra; chamfered weatherboards, $3.07 extra.

Following are the prices of planed lumber (tongued-and-grooved stock), in the autumn of 1919, f. o. b. central Norrland ports, for shipment to the Netherlands and Germany: 11 inches wide, $85.26 per 1,000 feet board measure; 10 inches, $78.50; 9 inches, $74.44; 8½ inches, $71.73; 8 inches, $71.05; 7 and 6½ inches, $69.02; 6 inches, $68.35; 5½ inches, $68.01; 5 inches, $67.67; 4½ inches, $66.32; 4 inches, $65.64; and 3½ and 3 inches, $64.96. Extra charges are made as follows: ¾-inch stock, $0.68 extra per 1,000 feet; ¾-inch stock guaranteed to measure 18 millimeters, $2.04 extra; 1-inch stock guaranteed to measure 24 millimeters, $1.35 extra; ⅝-inch stock, $1.35 extra; ½-inch stock, $2.70 extra.

Following are the charges for resawing rough stock and for bundling lumber:

For resawing:	Per M feet.
Stock 6 inches and wider—	
1 cut	$2.46
2 cuts	3.07
3 cuts	3.69
4 cuts	4.30
Stock 5½ inches and less—	
1 cut	3.07
2 cuts	3.60
3 cuts	4.30
4 cuts	4.92

For bundling:	Per M feet.
Sawn and planed lumber—	
With string	$2.46
With wire	1.23
Staves—	
With string	4.30
With wire	3.07

Split wood (mill ends) is usually classified into first and second grades. Prices for split wood are quoted for three groups: (1) Planks and battens, (2) boards 6 inches and wider, and scantlings; and (3) narrow boards less than 6 inches wide. The difference in price between groups is approximately $2.86 per cubic fathom (216 cubic feet). First grade is sold at $9.65 per cubic fathom higher than the second grade. The prices before the war were approximately $20 for first grade of the first group. During 1918 and 1919 the corresponding price was about $60 per cubic fathom.

Cement staves vary in price according to dimensions. The average price for cement staves during the period 1918 to 1919 was approximately $40 to $45 per 1,000 feet board measure.

PRICES IN LOWER-GULF DISTRICT.

The following table shows the prices per 1,000 feet board measure of third-quality pine and unsorted-quality spruce, in some of the principal dimensions, for export from the lower-gulf district, from 1889 to 1913:

Years.	Third-quality pine.				Unsorted-quality spruce.			
	3 by 9 in.	2½ by 7 in.	1 by 6 in.	1 by 4 in.	3 by 9 in.	2½ by 7 in.	1 by 6 in.	1 by 4 in.
1889	$20.28	$16.90	$15.05	$12.29	$16.28	$13.52	$13.21	$10.75
1890	18.43	14.13	12.90	8.29	14.75	11.97	11.36	7.68
1891	16.90	12.90	11.36	7.37	13.83	11.05	10.44	7.68
1892	18.43	13.52	12.29	8.60	15.36	11.36	10.75	8.29
1893	19.36	13.83	12.60	8.91	15.67	11.97	11.36	7.68
1894	19.36	14.44	12.90	8.91	15.36	12.60	11.97	8.29
1895	17.51	14.44	12.90	9.82	14.75	12.90	12.29	8.60
1896	18.43	15.36	13.83	11.36	15.98	13.83	13.52	10.75
1897	19.97	16.90	15.67	13.21	17.20	15.67	15.36	13.21
1898	20.89	18.13	16.90	14.44	16.59	15.67	15.05	11.67
1899	22.43	18.74	17.82	14.13	17.51	15.36	14.75	11.36
1900	26.42	19.97	19.05	15.36	20.58	16.90	16.59	13.21
1901	27.04	18.74	17.51	12.60	20.58	15.98	15.36	10.75
1902	27.34	19.36	17.51	12.90	20.89	16.59	16.28	11.97
1903	29.19	20.28	18.43	14.13	19.66	17.51	18.13	13.83
1904	25.81	19.36	17.51	14.44	18.43	16.28	15.67	13.21
1905	21.81	18.74	17.20	14.75	18.74	14.13	16.28	13.83
1906	22.74	20.58	19.66	17.20	21.20	18.74	18.13	16.28
1907	23.35	21.51	20.58	18.74	21.20	18.43	18.13	16.59
1908	22.43	19.97	19.05	16.59	20.89	16.59	16.90	15.05
1909	24.58	20.58	19.66	17.82	22.74	19.05	18.74	16.59
1910	27.34	21.81	21.20	18.74	23.66	19.66	19.36	17.51
1911	25.81	20.89	19.97	18.13	22.74	19.05	18.43	16.28
1912	24.89	20.89	20.28	18.13	22.12	19.36	18.74	16.90
1913	26.42	22.43	21.81	19.05	24.58	20.28	20.28	18.43

The following quotations per 1,000 feet board measure are representative of standard shipments from the lower-gulf shipping ports in April, 1913:

Dimensions.	Pine.				Unsorted grade.	
	First grade.	Second grade.	Third grade.	Fourth grade.	Pine.	Spruce.
4 by 11 inches	$44.24	$39.33	$30.72	$25.19	$29.49	$28.88
4 by 9 inches	43.01	38.10	28.26	25.19	28.26	25.81
3 by 11 inches	44.24	39.33	30.72	25.19	29.49	28.88
3 by 9 inches	41.78	36.87	27.65	25.19	27.65	25.19
3 by 8½ inches						23.66
3 by 8 inches	31.95	27.04	23.96	22.12	23.96	21.51
3 by 7 inches	31.34	26.42	23.35	21.51	23.35	20.89
3 by 6½ inches	30.72	25.81	22.12	20.28	22.12	20.58
3 by 6 inches	30.11	25.19	21.51	19.66	22.12	20.58
3 by 5½ inches					23.35	
3 by 5 inches					23.35	
3 by 4½ inches					23.35	
3 by 4 inches					19.66	
2½ by 11 inches	44.24	39.33	30.72	25.19	29.49	28.88
2½ by 9 inches	41.78	36.87	27.65	25.19	27.65	25.19
2½ by 8 inches	31.95	27.04	23.96	22.12	23.96	21.51
2½ by 7 inches	31.34	26.42	23.35	21.51	23.35	20.89
2½ by 6½ inches	30.72	25.81	22.12	20.28	22.12	20.58
2½ by 6 inches	30.11	25.19	22.12	20.28	22.12	20.58
2½ by 5½ inches					20.28	19.66
2½ by 5 inches					20.28	19.66
2½ by 4½ inches					19.05	
2½ by 4 inches					19.66	
2 by 11 inches	44.24	39.33	30.72	25.19	29.49	28.88
2 by 9 inches	41.78	36.87	27.65	25.19	27.65	25.19
2 by 8 inches	31.95	27.04	23.96	22.12	23.96	21.51
2 by 7 inches	31.34	26.42	23.35	21.51	23.35	20.89
2 by 6 inches	30.11	25.19	22.12	20.28	22.12	20.58
2 by 5½ and 5 inches					20.28	19.66
2 by 4½ inches					19.05	19.66
2 by 4 inches					19.66	19.04
Boards:						
11 inches	52.84	47.93	31.34	25.81	31.64	
9 inches	50.39	45.47	30.72	25.81	31.03	25.81
8 inches	41.78	36.87	25.81	23.34	26.11	22.12
7 inches	39.33	34.41	23.96	22.12	24.27	21.51
6½ inches	38.10	33.18	22.74	20.89	23.04	20.89
6 inches	38.10	33.18	22.74	20.89	23.04	20.89
5½ inches	37.48	32.57	22.12	20.28	22.12	20.28
5 inches	37.48	32.57	22.12	20.28	22.12	20.28
4½ inches	35.64	30.72	20.89	19.05	20.89	19.36
4 inches	34.72	29.80	19.97	18.13	19.97	19.36
3½ inches					18.74	18.74
3 inches					18.74	18.74

For fifth-grade pine and spruce the prices received, f. o. b., lower-gulf shipping ports, in April, 1913, were less than those for the unsorted grade by the following amounts: Planks, $4.30 to $4.92 less; battens and boards, $2.46 to $3.07; and discolored lumber, $2.46 to $3.07.

The table following shows the quotations in the autumn of 1919 for rough lumber of pine and spruce, f. o. b. lower-gulf shipping ports, for delivery in the United Kingdom in the spring of 1920. The same prices applied to France, Belgium, Spain, Portugal, and the Mediterranean countries.

Widths.	Planks, battens, and scantlings.		Boards.	
	Unsorted and third grade.	Fifth grade.	Unsorted and third grade.	Fifth grade.
	Per M ft.	*Per M ft.*	*Per M ft.*	*Per M ft.*
12 and 11 inches	$86.02	$71.28	$88.48	$71.28
10 and 9 inches	73.73	68.82	76.19	68.82
8½ inches	71.28	66.98	72.51	66.98
8 inches	70.66	66.98	71.89	66.98
7 and 6½ inches	68.82	65.13	70.05	65.13
6 inches	67.59	63.90	68.82	63.90
5½ and 5 inches	66.36	62.67	67.59	62.67
4½ inches	66.36	62.67	66.36	61.45
4 inches	66.36	62.67	65.75	60.83
3½ and 3 inches	66.36	62.67	63.29	78.35

The relative prices of other grades and dimensions than those given in the table were as follows: For ¾ inch and ⅝ inch by 6 inches and wider, unsorted grade, $1.23 per 1,000 feet higher than boards, unsorted grade; for first-grade planks and battens, $9.83 higher than for third grade; for first-grade boards, $12.29 higher than for third grade; for second-grade planks and battens, $4.91 higher than for third grade; for second-grade boards, $7.37 higher than for third grade; for fourth-grade 12 and 11 inch planks, $4.91 lower than for third grade; for fourth-grade 12 and 11 inch boards, $8.60 lower than for third grade; for fourth-grade 10 and 9 inch planks, $2.46 lower than for third grade; for 10 and 9 inch boards, $4.91 lower than for third grade; and for all other dimensions, $1.84 lower than for third grade.

The following table shows quotations in the summer of 1919 on different dimensions and grades of rough lumber of pine and spruce, f. o. b. lower-gulf ports, for shipment to Denmark:

Widths.	First grade.	Second grade.	Third and unsorted grades.	Fourth grade.	Fifth grade.
	Per Mft.	*Per Mft.*	*Per Mft.*	*Per Mft.*	*Per Mft.*
12 inches	$105.08	$100.16	$90.33	$86.61	$66.98
11 inches	100.16	95.24	85.41	81.72	66.98
10 inches	95.24	90.33	80.49	76.81	65.75
9 inches	85.41	80.49	73.12	70.66	65.75
8 inches	78.04	73.12	65.75	63.90	62.06
7 inches	76.19	71.28	63.90	62.06	60.22
6½ and 6 inches	75.58	70.66	63.29	61.45	59.60
5½ inches	74.96	70.05	62.67	60.83	58.99
5 inches	74.35	69.43	62.06	60.22	58.37
4½ inches	73.12	68.20	60.83	58.99	55.92
4 inches	71.89	66.98	59.60	57.76	54.69
3½ and 3 inches	70.66	65.75	58.37	56.53	53.46

For planed lumber the following additional charges were made: Tongued, grooved, and beaded stock (t. g. b.), 1¼ and 1 inch thick, $3.69 for planing charges added to price of rough stock; for t. g. b. stock, three-fourths and five-eighths inch thick, $4.30 planing charges added to price of rough stock.

The following table shows the prices per 1,000 feet nominal measure of planed lumber (pine or spruce, surfaced on four sides), in the autumn of 1919, f. o. b. lower-gulf port, for shipment to the United Kingdom. These prices also apply to France, Belgium, Spain, Portugal, and the Mediterranean countries.

Widths.	First grade.	Unsorted and second grade.	Third grade.	Fourth grade.
11 inches	$92.17	$87.25	$83.52	$79.88
9 inches	79.88	74.96	71.28	67.59
7 and 6½ inches	68.82	65.13	62.67	60.22
6 inches	68.20	64.52	62.06	59.60
5½ and 5 inches	67.59	63.90	61.45	58.99
4½ and 4 inches	66.98	63.29	60.83	58.37

The following extra charges are made per 1,000 board feet nominal measure: For tongued and grooved (t. g.), tongued, grooved, and beaded (t. g. b.), tongued, grooved, and V-jointed (t. g. v.), and

rebated and V-jointed (r. v.) stock, $0.61; t. g. b., t. g. v., and r. v., two sides, $1.23; three-fourths-inch stock, $0.61; five-eighths-inch stock, $1.23; one-half-inch stock, $2.46; and weatherboards, $2.46.

PRICES IN LOCAL MARKETS.

The local markets in Sweden are supplied chiefly by a number of small interior mills; the export mills do not generally engage in this business. Occasionally, however, the export mills may dispose of part of their cull stock in the local markets. Sweden consumes most of the cull lumber locally, while the better grades of construction lumber are exported to foreign countries.

The prices in the local market in Sweden for cull stock are usually higher than the prices for unsorted construction lumber abroad, because the domestic markets consume relatively small quantities, while the export lumber trade is carried on in cargo lots.

The usual dimensions required in the local markets in Sweden are as follows, for both pine and spruce: 3 by 9, 8, 7, and 6 inches; 2½ by 9 and 7 inches; 2 by 9, 8, 7, 6, and 5 inches; 1 and 1½ by 9, 8, 7, 6½, 6, 5½, 5, 4½, and 4 inches; ¾ by 7, 6½, 6, 5½, 5, 4½, and 4 inches. A limited quantity of one-half inch boards is in demand. In planed lumber the sizes required are ¾, 1, and 1½ inches by 7, 6½, 6, 5½, 5, 4½, and 4 inches.

During the winter of 1919 the following prices were quoted in Stockholm, the largest local market in Sweden:

	Per M feet.		Per M feet.
3 by 9 inches	$66. 64	1½ by 6½ inches	$58. 31
3 by 8 inches	61. 64	1½ by 6 inches	58. 31
3 by 7 inches	59. 14	1½ by 5½ inches	55. 81
3 by 6 inches	58. 31	1½ by 5 inches	55. 81
2½ by 9 inches	66. 64	1½ by 4½ inches	55. 81
2½ by 7 inches	59. 14	1½ by 4 inches	55. 81
2 by 9 inches	66. 64	1 by 9 inches	69. 14
2 by 8 inches	61. 64	1 by 8 inches	63. 31
2 by 7 inches	59. 14	1 by 7 inches	61. 64
2 by 6 inches	58. 31	1 by 6½ inches	59. 14
2 by 5 inches	55. 81	1 by 5½ inches	56. 64
1½ by 9 inches	66. 64	1 by 5 inches	56. 64
1½ by 8 inches	61. 64	1 by 4½ inches	55. 81
1½ by 7 inches	59. 14	1 by 4 inches	55. 81

Three-quarter inch stock is $1.08 higher than 7-inch boards and one-half inch stock is $2.25 higher than 7-inch boards.

The foregoing prices refer to gang-sawn lumber. If the lumber is sawn on circular saws, the prices are $1.08 less per 1,000 feet. The prices for pine and spruce are now the same. Previous to the war spruce was sold at approximately $2.25 less than pine. The planing charges are based on $6.66 per 1,000 feet board measure for 1-inch boards. For ¾-inch boards the charge is $7.83 and for ½-inch boards $10. The average length of rough stock, planks, and battens is about 14 feet and of rough and planed boards 13 feet. The prices refer to a grade corresponding to fourth grade for export, but also containing a certain percentage of fifth-grade stock. Fifth-grade stock containing a small percentage of sixth grade is sold at $2.25 discount. Cull stock, sixth grade and poorer, is sold at about $50 per 1,000 feet for all sizes. These prices represent an advance of approximately 100 per cent over the prices ruling before the war.

Considerable quantities of torrac pine are used in the construction of houses in Sweden.

PRICE-CONVERSION TABLE.

Price quotations are so often given in pounds sterling per standard that the following conversion table from pounds per standard to United States currency per 1,000 feet board measure will be found convenient:

TABLE TO CONVERT POUNDS STERLING PER PETROGRAD STANDARD, SAWN AND PLANED LUMBER, TO DOLLARS PER M FEET BOARD MEASURE (1 PETROGRAD STANDARD=1,980 BOARD FEET; £1=$4.8665).

Sterling.	U. S. currency.	Sterling.	U. S. currency.	Sterling.	U. S. currency.	Sterling.	U. S. currency.	Sterling.	U. S. currency.
£ s. d.	*Dollars.*	£ s. d.	*Dollars.*	£ s. d.	*Dollars.*	£ s. d.	*Dollars.*	£ s. d.	*Dollars.*
5 0 0	12.2891	11 0 0	27.0361	17 0 0	41.7830	23 0 0	56.5300	29 0 0	71.2770
5 2 6	12.5962	11 2 6	27.3432	17 2 6	42.0901	23 2 6	56.8371	29 2 6	71.5841
5 5 0	12.9037	11 5 0	27.6507	17 5 0	42.3976	23 5 0	57.1446	29 5 0	71.8916
5 7 6	13.2108	11 7 6	27.9578	17 7 6	42.7047	23 7 6	57.4517	29 7 6	72.1987
5 10 0	13.5178	11 10 0	28.2648	17 10 0	43.0117	23 10 0	57.7581	29 10 0	72.5057
5 12 6	13.8254	11 12 6	28.5724	17 12 6	43.3193	23 12 6	58.0663	29 12 6	72.8133
5 15 0	14.1325	11 15 0	28.8795	17 15 0	43.6264	23 15 0	58.3734	29 15 0	73.1204
5 17 6	14.4396	11 17 6	29.1866	17 17 6	43.9335	23 17 6	58.6805	29 17 6	73.4275
6 0 0	14.7469	12 0 0	29.4939	18 0 0	44.2409	24 0 0	58.9878	30 0 0	73.7348
6 2 6	15.0540	12 2 6	29.8010	18 2 6	44.5480	24 2 6	59 2949	30 2 6	74.0419
6 5 0	15.3615	12 5 0	30.1085	18 5 0	44.8555	24 5 0	59.0024	30 5 0	74.3494
6 7 6	15.6686	12 7 6	30.4156	18 7 6	45.1626	24 7 6	59.9095	30 7 6	74.6565
6 10 0	15.9756	12 10 0	30.7226	18 10 0	45.4696	24 10 0	60.2165	30 10 0	74.9635
6 12 6	16.2832	12 12 6	31.0302	18 12 6	45.7772	24 12 6	60.5241	30 12 6	75.2711
6 15 0	16.5903	12 15 0	31.3373	18 15 0	46.0843	24 15 0	60.8312	30 15 0	75.5782
6 17 6	16.8974	12 17 6	31.6444	18 17 6	46.3914	24 17 6	61.1383	30 17 6	75.8853
7 0 0	17.2048	13 0 0	31.9517	19 0 0	46.6987	25 0 0	61.4457	31 0 0	76.1926
7 2 6	17.5119	13 2 6	32.2588	19 2 6	47.0058	25 2 6	61.7528	31 2 6	76.4997
7 5 0	17.8194	13 5 0	32.5663	19 5 0	47.3133	25 5 0	62.0603	31 5 0	76.8072
7 7 6	18.1265	13 7 6	32.8734	19 7 6	47.6204	25 7 6	62.3674	31 7 6	77.1143
7 10 0	18.4335	13 10 0	33.1804	19 10 0	47.9274	25 10 0	62.6744	31 10 0	77.4213
7 12 6	18.7411	13 12 6	33.4880	19 12 6	48.2350	25 12 6	62.9820	31 12 6	77.7289
7 15 0	19.0482	13 15 0	33.7951	19 15 0	48.5421	25 15 0	63.2891	31 15 0	78.0360
7 17 6	19.3553	13 17 6	34.1022	19 17 6	48.8492	25 17 6	63.5962	31 17 6	78.3431
8 0 0	19.6626	14 0 0	34.4096	20 0 0	49.1565	26 0 0	63.9035	32 0 0	78.6505
8 2 6	19.9697	14 2 6	34.7167	20 2 6	49.4636	26 2 6	64.2106	32 2 6	78.9576
8 5 0	20.2772	14 5 0	35.0242	20 5 0	49.7711	26 5 0	64.5181	32 5 0	79.2651
8 7 6	20.5843	14 7 6	35.3313	20 7 6	50.0782	26 7 6	64.8252	32 7 6	79.5722
8 10 0	20.8913	14 10 0	35.6383	20 10 0	50.3852	26 10 0	65.1322	32 10 0	79.8792
8 12 6	21.1989	14 12 6	35.9459	20 12 6	50.6928	26 12 6	65.4398	32 12 6	80.1868
8 15 0	21.5060	14 15 0	36.2530	20 15 0	50.9999	26 15 0	65.7469	32 15 0	80.4939
8 17 6	21.8131	14 17 6	36.5601	20 17 6	51.3070	26 17 6	66.0540	32 17 6	80.8010
9 0 0	22.1204	15 0 0	36.8674	21 0 0	51.6143	27 0 0	66.3613	33 0 0	81.1083
9 2 6	22.4275	15 2 6	37.1745	21 2 6	51.9214	27 2 6	66.6684	33 2 6	81.4154
9 5 0	22.7350	15 5 0	37.4820	21 5 0	52.2289	27 5 0	66.9759	33 5 0	81.7229
9 7 6	23.0421	15 7 6	37.7891	21 7 6	52.5360	27 7 6	67.2830	33 7 6	82.0300
9 10 0	23.3491	15 10 0	38.0961	21 10 0	52.8430	27 10 0	67.5900	33 10 0	82.3370
9 12 6	23.6567	15 12 6	38.4037	21 12 6	53.1506	27 12 6	67.8976	33 12 6	82.6446
9 15 0	23.9638	15 15 0	38.7108	21 15 0	53.4577	27 15 0	68.2047	33 15 0	82.9517
9 17 6	24.2709	15 17 6	39.0179	21 17 6	53.7648	27 17 6	68.5118	33 17 6	83.2588
10 0 0	24.5782	16 0 0	39.3252	22 0 0	54.0722	28 0 0	68.8191	34 0 0	83.5661
10 2 6	24.8853	16 2 6	39.6323	22 2 6	54.3793	28 2 6	69.1262	34 2 6	83.8732
10 5 0	25.1928	16 5 0	39.9398	22 5 0	54.6868	28 5 0	69.4337	34 5 0	84.1807
10 7 6	25.4999	16 7 6	40.2469	22 7 6	54.9939	28 7 6	69.7408	34 7 6	84.4878
10 10 0	25.8069	16 10 0	40.5539	22 10 0	55.3009	28 10 0	70.0478	34 10 0	84.7948
10 12 6	26.1145	16 12 6	40.8615	22 12 6	55.6085	28 12 6	70.3554	34 12 6	85.1024
10 15 0	26.4216	16 15 0	41.1686	22 15 0	55.9156	28 15 0	70.6625	34 15 0	85.4095
10 17 6	26.7287	16 17 6	41.4757	22 17 6	56.2227	28 17 6	70.9696	34 17 6	85.7166

COMPARISON OF SWEDISH AND AMERICAN SOFTWOOD LUMBER.

It is difficult to find any wood in the United States comparable with Swedish pine and spruce. Up to the present time Swedish lumber has faced competition only with Douglas fir and southern yellow pine, which are different in many respects from the Swedish species.

The American exporter has the great advantage of being able to supply lumber having special qualities; for instance, rot-resisting, fire-resisting, and especially strong construction material, pattern wood, cabinet woods, etc. But he has not yet availed himself of this opportunity by advocating his products for special purposes.

The principal advantageous features of Douglas fir and southern yellow pine are the wide stock and long lengths that can be supplied. From the Swedish export statistics it may be seen that the output for export of lumber 8½ inches and wider is only about 20 per cent and that such stock is sold at a very heavy increase above the narrower sizes. Swedish stock can not generally be supplied with any large quantities of lumber 20 feet and more in length, and any order calling for specified lengths commands extra charges.

However, extra long and extra wide lumber is sometimes ordered only to be resawn. In South American countries, for example, long timber is frequently cut into several shorter lengths. But it is possible to educate the market to order what it actually needs.

A Spanish house, closely cooperating with the Swedish exporters in extending the interest in Swedish lumber, states in its Spanish price lists that "as long lengths of Swedish lumber are higher priced, customers are requested not to specify longer lengths than are necessary."

Formerly South Africa took only planks which were resawn in that country. But the Swedish exporters extended their market materially by making importers understand that they could supply narrow sizes at reduced prices.

The Swedish lumber has the advantage of being cut to a smaller standard of measurement than the American lumber. Swedish lumber is trimmed on odd and even feet and the boards are cut on the one-half inch in width and on the one-quarter or even on the one-eighth inch in thickness. Practically any size of stock can be produced, but if odd dimensions are ordered an additional charge is made.

MANUFACTURE.

Accuracy of manufacture is the principal advantage of Swedish lumber. It is always true to size—neither more nor less than the specifications. Trade Commissioner Simmons's investigation in South America illustrates the difference between Southern yellow pine and Swedish pine in this respect. (See fig. 70.)

QUALITY.

The small percentage of clears and upper grades is the most serious handicap for Swedish lumber, and here American lumber has a great advantage. Otherwise Swedish stock is sound construction lumber; there are no large loose knots except in cull grades. There is a large number of knots, but they are firmly incased and solid. Swedish lumber is very serviceable for general-utility purposes. It is of medium weight, has considerable breaking strength, and is medium hard, easily worked, and fairly rot-resistant (pine).

Of special stock, such as rift grain, heart wood, etc., the yield is so small as to be practically negligible.

FIG. 110.—TYPE OF OCEAN-GOING VESSEL USED BY INTERIOR MILLS.

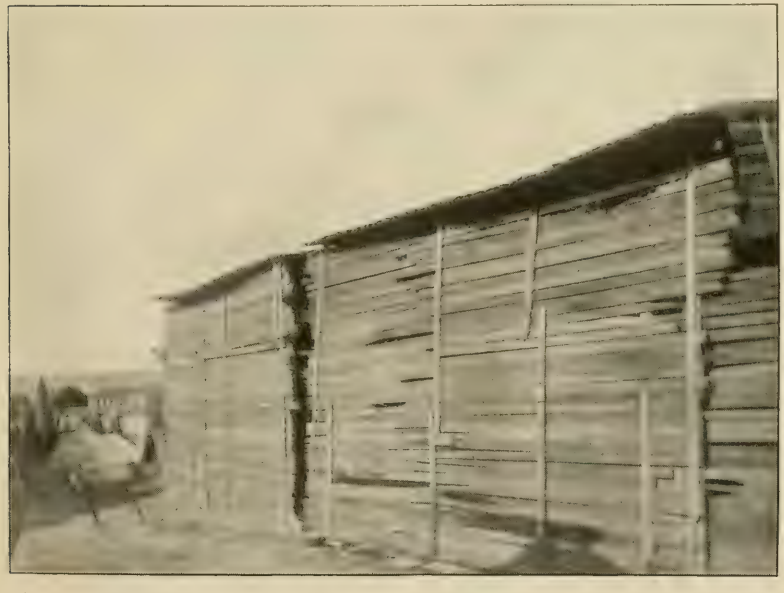


FIG. 111.—LUMBER PAID FOR BUT LEFT BY IMPORTER BECAUSE OF LACK OF SHIPPING FACILITIES. EXPORTERS CAREFULLY STORED THIS PARCEL WITHOUT ADDITIONAL CHARGE.

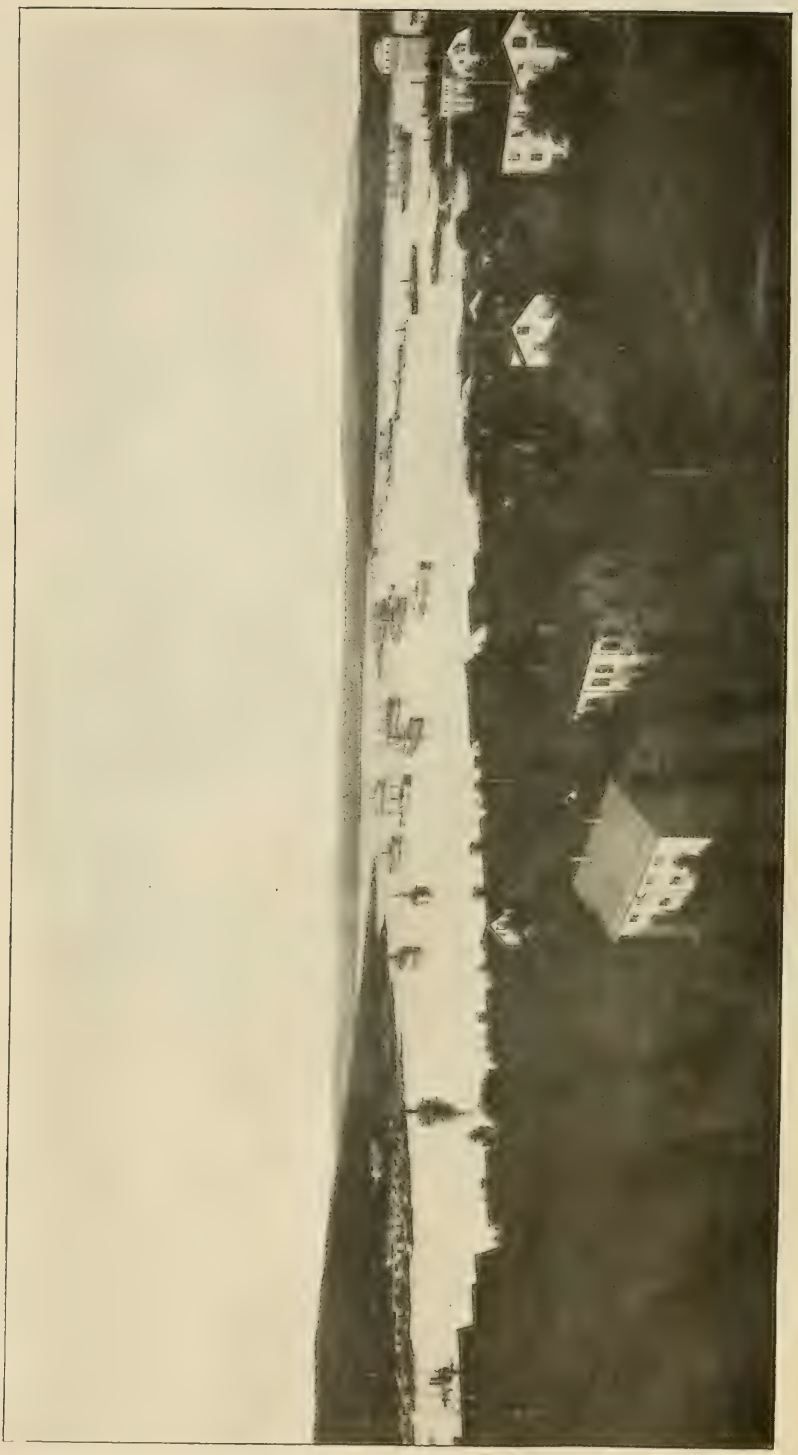


FIG. 112.—TWENTY-TWO STEAMERS LOADING LUMBER, HERNOSAND DISTRICT.

GRADING.

There are no absolutely uniform grading rules in Sweden, but there is no greater variation between shipments of the same grade from any two standard export mills in Sweden than is admitted by the American grading rules of lumber for export. The United States has to offset the theoretical advantage of uniform grading rules by the fact that (1) they are said by some to be too elastic and (2) some shippers do not maintain the grades. In Sweden the grades are not uniform for all mills, but the grades for each mill are uniform from year to year.

The excellent marketing methods, the branding of every piece of lumber, planed and rough, for export, adequate steamship connections with the principal markets, arbitration service abroad, and other factors have built up the export trade in Swedish lumber, in spite of its inferiority in both quality and size as compared with the principal American softwoods exported.

FUTURE OF SWEDISH FORESTS, LUMBER INDUSTRY, AND LUMBER EXPORT TRADE.

The future supply of wood for the Swedish lumber and pulp industries seems to be amply safeguarded by the new forest laws and the thorough understanding on the part of the larger forest owners in regard to the conservation and judicious management of their holdings. Recently the smaller holders also have taken a keen interest in the better management of their forests, mainly on account of the high value of forest products, and they have been greatly assisted by the work of the forest commissions in the different parts of the country. The draining of swamps and planting of cut-over areas are progressing very rapidly and no doubt will be one of the main features of the Swedish forest policy in the following decades.

The aim of the Swedish forest owners will be to decrease the age of maturity for cutting. When the results of the new forest laws, reforestation, and draining activities are realized, it is expected that the stands of the Swedish forests will be materially increased. One may therefore look forward to a higher yield of the Swedish forests in the future than they are giving at present. The cutting out of large areas of forests is out of the question because the forests are so important an asset that public attention is constantly focused on them.

The lumber and the pulp industry must always be among the leading industries in Sweden. Which of the two will be the more important is difficult to say, as the development depends largely upon the relative demand for lumber and pulp products in the world's markets. The tendency has been toward a further development of the pulp industry, while it seems that the lumber industry has already reached its climax. In this connection, it must be noted that the majority of the pulp mills in Sweden are owned and controlled, wholly or in part, by the lumber mills, and that these concerns can easily change from one industry to the other when conditions warrant.

It is not expected that any large number of new mills will be constructed in southern Sweden or in southern or central Norrland. In northern Norrland, on the other hand, there are still vast areas of forests that have not been exploited to any great extent up to the present time. As these regions are principally pine forests, and as pine is not used for pulp to any great extent, it is evident that these regions will be exploited mainly by the lumber mills. The Government has the largest holdings of timber in this part of the country, and it depends a great deal upon the action taken by the State whether new mills will be constructed in the near future.

It has been difficult at times, in other parts of Sweden, for a number of the mills to obtain the necessary raw material at a reasonable cost, and their capacity is in excess of their average annual output during the last few years. It would not be necessary, therefore, to construct new mills in the rest of Sweden in order to increase production.

While there always will be a market for Swedish rough lumber, the prospects of the Swedish planing mills and box factories are rather uncertain. The capacity of these mills has been increased largely

during the war to satisfy the abnormal demand for war material. As several countries will probably protect their native planing-mill industries by imposing a duty on imported planed stock, a large increase in the output of the Swedish planing mills and box factories is not to be expected in the near future.

The question of manufacturing wooden articles that before the war were made from Swedish lumber in Germany and other countries has been given serious consideration in Sweden, and many of the Swedish planing mills and box factories will probably engage in such activities if the market for planing-mill products should be curtailed to any great extent.

The per capita consumption of wood in Sweden is very large, particularly in the rural districts, where large quantities of wood are wasted annually for purposes which cheaper substitutes would serve just as well. If the present high prices of wood and wood products should be maintained they will doubtless lead to a decreased domestic consumption of wood, as the lumber and pulp manufacturers would take energetic steps to obtain increased quantities of raw material.

The development of waterpower in Sweden will also have an important effect upon the consumption of wood in that country.

The markets for Swedish lumber are well established and unless the exports of lumber from Russia should increase materially over the pre-war figure, the Swedish lumber exporters will probably be able to hold their present markets. It is not believed that any country other than Russia would be able seriously to curtail the markets for Swedish lumber.

For the next five or ten years, therefore, one may count on annual lumber exports from Sweden of 1,800,000,000 to 2,000,000,000 feet, board measure, provided that the foreign markets can consume these quantities.

Many steamship lines have been established in the last few years, and as the Swedish merchant marine is now being developed to a large extent and new steamship lines will be established in the future, the Swedish lumber exporters will have better opportunities than before to place their lumber in new markets, particularly in countries outside of Europe.

For several years before the war the tendency was to spread over a larger field. Several of the far-away markets have been able to pay higher prices for Swedish lumber than the European markets. The lumber-export trade is based on an adequate supply of raw material, careful manufacturing and seasoning, and an intelligent system of exporting, which, in connection with adequate transportation facilities, will always maintain Sweden in its position among the leading lumber-exporting countries in the world.

APPENDIXES.

Appendix A.—SWEDISH IMPORTS OF WOODS.

None of the three north European countries, Sweden, Norway, and Finland, has an adequate supply of hardwoods. Sweden is probably in a better position in this respect than the other two countries, but the supply of hardwoods in Sweden is not sufficient to cover the domestic demand.

The hardwoods found in Sweden are birch, oak, alder, aspen, beech, ash, and a few species of minor importance. Birch is the most important of these species and the one of which there is the largest supply. Birch is used as a general-utility wood, but it is difficult to obtain clear birch logs and logs of large dimensions and as the same conditions apply to the other species mentioned, it is evident that Sweden must be dependent on other countries for its supply of the upper grades of hardwoods. This is true also of the upper grades of softwoods. The spruce and pine in Sweden must be termed common construction lumber not suitable for the highest grade joinery and finish. The imports of softwoods are small, however; hardwoods constitute the bulk of the Swedish imports of wood.

The accompanying table shows the imports of foreign logs, hewn timber, and lumber into Sweden from 1911 to 1916, by principal countries of origin. (The importation of Finnish and Norwegian logs has been discussed in previous chapters.)

IMPORTS INTO SWEDEN OF LOGS, HEWN TIMBER, AND LUMBER, BY COUNTRIES OF ORIGIN, FROM 1911 TO 1916.

Countries of origin.	1911	1912	1913	1914	1915	1916
LOGS.[a]	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
Norway	25					207
Finland	97,489	95,832	101,004	101,211	80,923	124,888
Russia	17,705	15,528	22,320	17,091		
Denmark	156	295	333	621	188	161
Germany	523	454	1,349	715	576	196
United Kingdom		321	259	263	84	
United States	435	63	152	82	105	121
All other countries	535	62	55	51	169	559
Total	116,868	112,555	125,472	120,034	82,045	126,201
Hewn timber [b]	(c)	185	755	336	371	52
STAVES, BOARDS, PLANKS, BATTENS, AND SCANTLINGS.[d]						
Norway	2,997	1,643	1,981	1,313	1,119	1,312
Finland	2,252	2,622	5,822	7,896	5,389	7,047
Russia		264	440	650		648
Denmark	997	1,255	1,658	1,244	1,698	1,109
Germany (including Luxemburg)	1,219	2,042	2,157	1,612	667	4,206
Netherlands						80
Belgium	113	299	456	338		
United Kingdom	62	27	127	112	28	
Siam				52		
United States	970	2,036	1,255	1,164	1,343	759
All other countries	253	1,751	240	331	105	23
Total	8,863	11,939	14,136	14,712	10,349	15,184

[a] Including a small quantity of hewn timber. Figures for 1911 do not show logs and hewn timber separately. Since most of the timber imported was logs, the conversion factor used was 283 board feet to the cubic meter.

[b] Conversion factor, 353 board feet to the cubic meter.

[c] Not stated separately in 1911.

[d] Conversion factor, 424 board feet to the cubic meter.

The Swedish statistics consider the country of origin as the last country from which the lumber was shipped before it reached Sweden. Therefore such countries as Germany and Denmark, together with Belgium, Norway, and the United Kingdom, figure prominently as exporters of lumber to Sweden. It is certain that only small quantities of native species (with the exception of German oak from Germany) were exported to Sweden from these countries and that the lumber and logs credited these countries in the statistics must have originated elsewhere and been reexported or transshipped to the Swedish markets.

Basing a study of the importation of foreign woods on the last normal year before the war, 1913, it is seen that Japan exported the largest quantity of hewn timber, which represented Japanese oak.

The imported aspen logs came from Russia and were used almost exclusively by the match factories in Sweden. Oak logs also were imported from Russia and Germany. Mahogany was chiefly reexported from Germany, Denmark, and the United Kingdom; only a small portion came from the United States.

Finland exported considerable quantities of staves to Sweden. No species are given for these staves in the Swedish statistics, but it appears from the Finnish export statistics that they represented pine and spruce stock.

Of sawn lumber of other species considerable quantities were exported from the United States to Sweden, but the bulk of the lumber was imported from Germany.

As it appears from these statistics, the United States played a comparatively insignificant part as a supplier of logs and lumber to Sweden, but large quantities of American lumber were undoubtedly included in the exports of lumber to Sweden from Germany, England, Denmark, Belgium, and other countries.

SPECIES OF LUMBER IMPORTED.

Oak has been and always will be the principal foreign species imported into Sweden. American white oak is unquestionably the most popular foreign wood in Sweden. It is claimed by the importers that this oak is more uniform in color and better manufactured than the oak imported from other countries. Furthermore, each piece of American oak lumber is graded and edged, although complaints were heard that the American grading rules change almost yearly.

German oak planks and boards are imported in large quantities into Sweden. The German oak lumber is not edged, but is shipped and sold in the form of the logs from which it is sawn (see fig. 114). While each piece of American oak is graded and edged, the German mills base the grading on the log. The German system of selling the entire log has the advantage that the carpenters are better enabled to match the different boards and planks for cabinetmaking, so as to obtain the same figuring of wood in panels and other matched stock.

Japanese oak was imported in small quantities immediately before the war and seemed to give satisfaction, mainly on account of its cheapness. The same criticisms have been offered in Sweden as have been usually heard in the United States in regard to the texture and other properties of Japanese oak. Part of this oak was imported direct from Japan on the regular liners between that country and Sweden, but some quantities were also reexported to Sweden from Germany.

Swedish oak does not compare with German and American oak, being generally considerably coarser and of uneven color. While the German and American oak are used for the better class of furniture and finish, Swedish oak is used for rough work and for the cheaper class of furniture. German and American oak are used for floors, furniture, and a multitude of purposes for which these woods are especially adapted.

Mahogany is used principally for furniture, finish, and similar purposes and also to some extent in ship construction.

Southern yellow pine and Douglas fir have been used to some extent in shipbuilding, dock construction, piling, etc., but native pine and spruce are used whenever possible, and the cheapness of the native species makes competition very keen for the two American woods. Southern yellow pine and Douglas fir have been imported, therefore, only in long and wide stock and in the upper grades, because such stock either can not be obtained in Sweden or can be had only at much higher prices.

Of other foreign species imported in limited quantities may be mentioned hickory for ski stock and Hungarian ash for finish. Red gum has been imported in logs and manufactured in Sweden into veneers. Yellow poplar is used for making of veneer pattern wood, etc., and was formerly very popular, but during recent years the prices have been too high for the Swedish market to use this wood for many purposes. Siamese teak is used in shipbuilding and car construction, but this wood also has increased materially in price and cheaper woods are used whenever possible. No suitable substitute for this wood has been found for ship decking, etc. Austrian spruce is used for musical instruments (sounding boards, piano keys, etc.). There are a few other species of foreign woods of minor importance.

WOOD-USING INDUSTRIES.

Although Sweden can not be said to be among the most important markets for American lumber, the country has many growing industries which use more or less foreign wood as raw material.

Sweden is a large producer of agricultural machinery and considerable foreign wood is consumed in its manufacture. The shipyards and boat-building plants consume important quantities of foreign soft and hard woods, especially for decking, as Swedish pine is not suitable for this purpose for the better class of ships.

The sash and door factories do not use foreign lumber to any great extent because the main production in Sweden is based on native lumber as raw material. However, for the better grades of sashes and doors some foreign oak, mahogany, etc., are used. The furniture factories, on the other hand, probably consume the largest quantities of foreign lumber in Sweden. This industry has been growing rapidly and is not only supplying the Swedish market but producing considerable furniture for exportation to near-by countries. Before the war foreign lumber was used extensively for furniture, but the difficulty of obtaining suitable stock from foreign countries during the war forced the furniture factories to use native hardwoods. These, however, are not satisfactory.

The railway-car shops also consume considerable foreign wood. For car siding Siamese teak has been used extensively for some years, but this material is now very expensive and the Swedish car shops are in the market for a less expensive wood.

Before the war the plants manufacturing telephone and telegraph apparatus used considerable quantities of walnut and oak. The factories for musical instruments, firearms, airplanes, automobiles, and carriages all use foreign lumber. The veneer factories use both native and foreign logs. This industry is growing materially, being protected by a high tariff.

The Swedish Government usually obtains its requirements from the Swedish importers.

Foreign lumber is not used to any great extent in the ordinary construction of houses in Sweden. Interior finish, sashes, doors, and floors are made of Swedish pine or spruce, which are painted. In the better class of houses in the Swedish cities the doors and floors, besides interior finish and trim, are often made of Swedish or foreign oak. In the larger cities the houses are very solidly constructed. Particularly the Swedish offices are elaborately equipped; oak and other high-grade lumber is extensively used.

METHODS OF IMPORTATION.

There are no resident agents in Sweden handling foreign lumber. The importers in Sweden have obtained their supplies of wood to some extent direct from the exporting countries, but they have purchased chiefly through foreign agents and importers, mainly Danish and German. At times these merchants split up cargoes among many smaller importers in Sweden and in the neighboring countries.

Before the war American lumber was either shipped in parcel lots to Sweden direct from the exporters in the United States without the use of middlemen or transshipped from Copenhagen, Hamburg, London, Liverpool, and other lumber centers in Europe.

German lumber was generally sold by agents through personal soliciting in Sweden, but it was often claimed that these German agents caused considerable dissatisfaction because they sold to importers, contractors, wholesalers, and consumers alike, without paying any attention to the handling of the lumber through the regular channels. During the latter part of the war Germany was practically the only source of supply for certain species of lumber, such as oak. The lumber was usually shipped by rail from southern Germany.

Previous to the war it was frequently contended by the Swedish importers conversant with the grading system in the United States that American lumber reexported from some of the European countries unquestionably had been tampered with; the grades sold to the Swedish merchants compared very unfavorably with the grades outlined in the American grading rules covering these species. The many middlemen between the Swedish importers and the American exporters have no doubt caused a heavy increase in the price that the Swedish importers had to pay for this stock, thereby seriously curtailing the sales of American lumber and its usefulness in Sweden.

PRICES.

It is of no interest to give a detailed account of the prices paid before the war or during the war, because the pre-war price level will never be reached again and the prices ruling during the war were exorbitant. The present market conditions are

unsettled, as any regular supply of foreign lumber has not yet been started, owing to shipping difficulties. The supplies of some foreign woods were very small in Sweden during the war on account of the blockade, and it was therefore a simple matter for the importers and dealers that had stocks on hand to hold them until the demand was so urgent that they could name their own prices.

Mahogany, which prior to the war was usually sold at about $2 per cubic foot, was sold during the war at about $15 per cubic foot. American oak, which usually before the war commanded approximately $1 per cubic foot, or somewhat less, was sold during the war even as high as at $6.50 per cubic foot. German oak was sold at about half of this price during the war, but the quality was often very unsatisfactory. In these circumstances it is of no avail to go into the matter of prices of foreign woods, which will come down as soon as the shipping situation is relieved.

In regard to native hardwoods, the following figures show the average prices per cubic foot paid for logs delivered at interior railway stations in southern Sweden from 1914 to 1918:

Kinds of wood.	1914	1915	1916	1917	1918
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Oak	21	21	27	34	40
Ash	29	34	40	40	67
Beech	17	19	19	20	31
Birch	11	12	13	24	25
Alder	11	12	13	24	25
Aspen	13	15	15	24	25

The consumer, however, paid much higher prices for these native species; for instance, oak lumber was sold at about $1.05 per cubic foot and birch at about $0.60 per cubic foot during 1918.

Russia was unable to furnish aspen logs during the latter part of the war, and this caused the Swedish match factories to use native hardwoods as raw material, which naturally increased the prices for these species.

PROSPECTS FOR FUTURE IMPORTS OF AMERICAN LUMBER.

Although Sweden, for reasons already given, may not offer a very important market for American lumber, it is believed that if a keener interest in this market is shown by American lumber exporters more can be done in Sweden than has been accomplished heretofore. American lumber has not been advertised to any extent and the handling of American lumber has been left to those who were not more interested in this stock than in Siamese teak, Central American mahogany, or German oak.

The importers visited in Sweden expressed their willingness to cooperate with American lumber exporters in furthering the sale of American lumber in Sweden. They should be supplied with full information regarding American lumber and its uses. The war prosperity that Sweden enjoys will result in increased building activities to relieve the present scarcity of dwellings. Although the Swedes are conservative, it would not take long to convince them of the merits of the better class of American soft and hard woods. The severe climate in Sweden calls for solid house construction, and as the Swedes always spend large sums on the equipment and construction of their homes, it is believed that American lumber should find a good market there in the coming years if properly advertised.

IMPORTERS.

There are comparatively few importers of foreign woods in Sweden and only a few of these importers are in a position to take any large quantities of foreign lumber at one time. This may be the reason why the Swedish importers have usually bought in parcel lots from merchants in other countries. Some of the houses handling imported woods are only small concerns, and many of them make a specialty of handling native hardwoods, carrying foreign wood only as a side line. The larger establishments maintain resawing plants for cutting logs and lumber.

[The names of the principal houses in Sweden engaged in handling foreign woods may be obtained from the Bureau of Foreign and Domestic Commerce or its district and cooperative offices. Inquirers should refer to file No. EUR–12031.]

Appendix β.—SWEDISH EXPORTS OF WOODS.[1]

TABLE I.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE ROUGH AND PLANED LUMBER FROM 1886 TO 1918.

Years.	Rough lumber (planks, battens, and boards).[a]		Planed boards.[a]		Total rough and planed.[a]
	M feet.	Percentage of total rough and planed.	M feet.	Percentage of total rough and planed.	M feet.
1886–1890, annual average	1,510,288	94.85	81,921	5.15	1,592,209
1891–1895, annual average	1,651,420	93.43	116,174	6.57	1,767,594
1886–1890, annual average	1,853,471	89.88	198,131	10.12	2,051,602
1901	1,563,941	87.25	228,536	12.75	1,792,477
1902	1,760,661	88.51	228,651	11.49	1,989,312
1903	1,776,575	86.29	282,160	13.71	2,058,735
1904	1,576,432	86.69	242,146	13.31	1,818,578
1905	1,673,922	87.09	248,157	12.91	1,922,079
1906	1,781,562	88.53	230,874	11.47	2,012,436
1907	1,515,787	87.11	224,352	12.89	1,740,139
1908	1,391,314	86.10	224,686	13.90	1,616,000
1909	1,249,267	86.62	193,012	13.38	1,442,279
1910	1,490,302	84.17	280,221	15.83	1,770,523
1911	1,496,205	84.29	278,929	15.71	1,775,134
1912	1,620,838	86.36	255,961	13.64	1,876,799
1913	1,669,140	85.19	290,276	14.81	1,959,416
1914	1,308,984	83.74	254,274	16.26	1,563,258
1915	1,690,047	88.66	216,232	11.34	1,906,279
1916	1,852,753	90.42	196,184	9.58	2,048,937
1917	1,040,532	91.87	92,044	8.13	1,132,576
1918	1,154,704	91.25	110,680	8.75	1,265,384

[a] Including box shooks prior to 1907.

TABLE II.—VALUE OF EXPORTS FROM SWEDEN OF PINE AND SPRUCE PLANKS, BATTENS, AND BOARDS (ROUGH STOCK), AND OF PLANED BOARDS, FROM 1904 TO 1916.

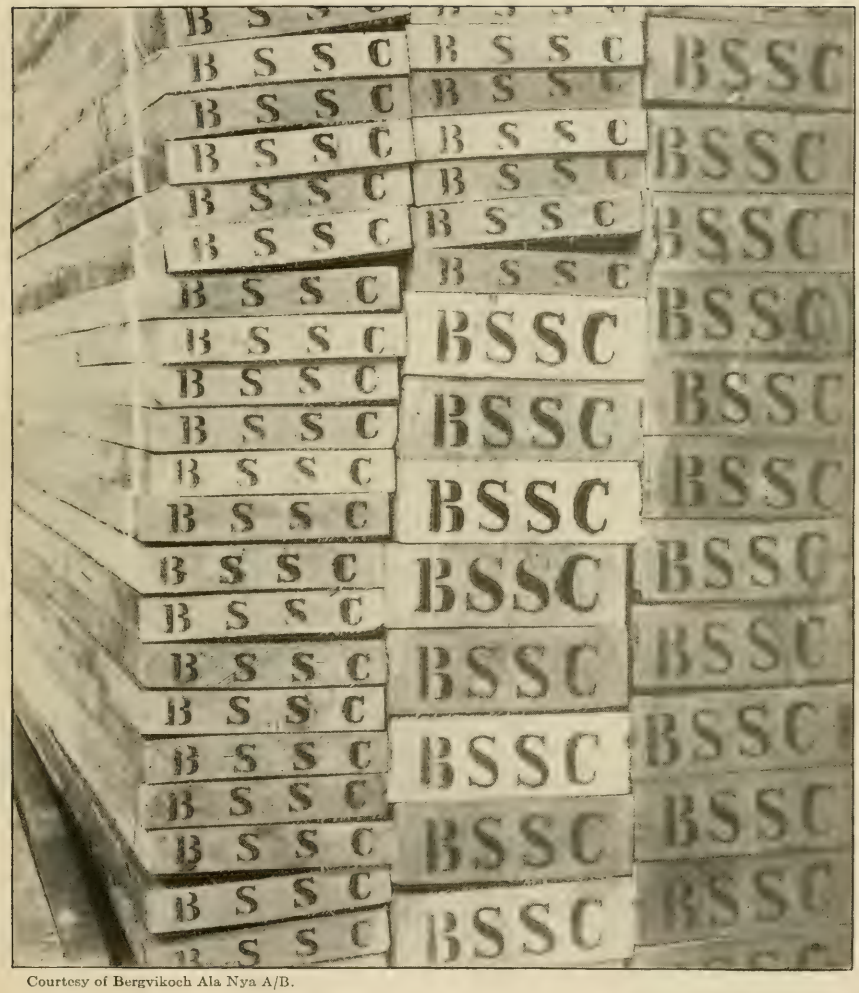
Years.	Planks, battens, and boards (rough stock).	Planed boards.	Years.	Planks, battens, and boards (rough stock).	Planed boards.
1904	[a] $25,535,000	[b] $4,470,000	1911	$29,215,000	$6,218,000
1905	[a] 27,063,000	[b] 4,612,000	1912	29,818,000	5,368,000
1906	[a] 33,002,000	[b] 4,636,000	1913	32,524,000	6,657,000
1907	30,244,000	4,717,000	1914	26,886,000	7,091,000
1908	24,093,000	4,200,000	1915	39,945,000	6,547,000
1909	23,820,000	4,127,000	1916	58,081,000	7,753,000
1910	30,541,000	6,429,000			

[a] Including box shooks. [b] Including planed box shooks.

TABLE III.—EXPORTS FROM SWEDEN OF TIMBER AND LUMBER OF DIFFERENT KINDS IN 1913.

Kinds of timber and lumber.	Cubic feet.	Per cent.	Kinds of timber and lumber.	Cubic feet.	Per cent.
Pine and spruce:			Other native species:		
Rough lumber	154,917,580	64.1	Round timber	362,249	22.8
Planed lumber	26,448,913	10.9	Hewn timber	47,408	3.0
Round timber	26,901,353	11.2	Firewood	903,715	56.8
Hewn timber	18,875,687	7.9	Sawn lumber	276,328	17.4
Firewood	14,048,871	5.9			
Total, pine and spruce	241,192,404	100.0	Total, other native species	1,589,700	100.0
			Grand total	242,782,104	

[1] Most of these tables are based on Swedish official statistics, the remainder were obtained through the courtesy of the Swedish Lumber Exporters' Association at Stockholm.



Courtesy of Bergvikoch Ala Nya A/B.

FIG. 113.—TRADE-MARKING OF LUMBER.

FIG. 114.—GERMAN OAK IMPORTED INTO SWEDEN.

FIG. 115.—SWEDISH OAK LOGS.

TABLE IV.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE PLANKS, BATTENS, BOARDS, AND BOX SHOOKS, PLANED AND ROUGH, BY CONTINENTS, FROM 1912 TO 1916.

Continents.	1912		1913		1914		1915		1916	
		Per ct.		Per ct.		Per ct.		Per ct.		Per ct.
Europe	$33,145,000	87.2	$36,800,000	87.2	$34,040,000	91.7	$50,489,000	96.9	$73,468,000	97.2
Africa	3,407,000	9.0	4,006,000	9.5	2,022,000	5.5	1,312,000	2.5	1,977,000	2.6
Asia	286,000	.8	181,000	.4	141,000	.4	39,000	.1	134,000	.2
America	475,000	1.2	258,000	.6	160,000	.4	61,000	.1	28,000	.....
Australia	686,000	1.8	966,000	2.3	740,000	2.0	198,000	.4	1,000	.....
Total	37,999,000	100.0	42,211,000	100.0	37,103,000	100.0	52,099,000	100.0	75,608,000	100.0

TABLE V.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE ROUGH LUMBER (PLANKS, BATTENS, SCANTLINGS, BOARDS, AND BOX SHOOKS), BY CONTINENTS, FROM 1905 TO 1913.

Years.	Europe.	Africa.	Asia.	Australia.	America.	Total.
1905:						
M feet	1,601,830	66,271	42	2,926	3,646	1,674,715
Value	$25,723,000	$1,218,000	$1,000	$56,000	$64,000	$27,062,000
Per cent	95.1	4.5	.....	0.2	0.2	100.0
1906:						
M feet	1,700,834	69,748	170	4,961	6,657	1,782,370
Value	$31,298,000	$1,451,000	$4,000	$106,000	$141,000	$33,000,000
Per cent	94.9	4.4	.....	0.3	0.4	100.0
1907:						
M feet	1,473,824	75,726	2,586	6,530	4,155	1,562,821
Value	$29,033,000	$1,588,000	$37,000	$143,000	$87,000	$30,888,000
Per cent	94.0	5.1	0.1	0.5	0.3	100.0
1908:						
M feet	1,335,430	89,761	933	8,777	5,936	1,440,837
Value	$22,954,000	$1,766,000	$17,000	$173,000	$110,000	$25,020,000
Per cent	91.7	7.1	0.1	0.7	0.4	100.0
1909:						
M feet	1,219,636	72,504	3,010	5,008	5,978	1,306,131
Value	$23,202,000	$1,565,000	$67,000	$110,000	$122,000	$25,066,000
Per cent	92.6	6.2	0.3	0.4	0.5	100.0
1910:						
M feet	1,398,988	122,833	5,215	13,738	10,939	1,551,713
Value	$28,364,000	$2,916,000	$120,000	$323,000	$238,000	$31,961,000
Per cent	88.7	9.1	0.4	1.0	0.8	100.0
1911:						
M feet	1,412,683	119,441	6,360	9,667	16,494	1,564,645
Value	$27,528,000	$2,729,000	$161,000	$222,000	$329,000	$30,969,000
Per cent	88.9	8.8	0.5	0.7	1.1	100.0
1912:						
M feet	1,544,876	126,098	5,512	9,243	20,564	1,706,293
Value	$28,478,000	$2,731,000	$132,000	$214,000	$405,000	$31,960,000
Per cent	89.1	8.5	0.4	0.7	1.3	100.0
1913:						
M feet	1,589,152	143,651	2,883	8,523	10,091	1,754,300
Value	$31,048,000	$3,174,000	$67,000	$197,000	$195,000	$34,681,000
Per cent	90.6	8.2	0.1	0.5	0.6	100.0

TABLE VI.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE PLANED BOARDS AND BOX SHOOKS, BY CONTINENTS, FROM 1905 TO 1913.

Years.	Europe.	Africa.	Asia.	Australia.	America.	Total.
1905:						
M feet	220,607	23,320	424	3,646	254	248,251
Value	$4,093,000	$438,000	$7,000	$67,000	$5,000	$4,610,000
Per cent	88.7	9.5	0.2	1.5	0.1	100.0
1906:						
M feet	205,767	17,172	170	6,572	1,314	230,995
Value	$4,123,000	$351,000	$3,000	$132,000	$27,000	$4,636,000
Per cent	88.9	7.6	0.1	2.8	0.6	100.0
1907:						
M feet	215,689	17,978	890	4,198	3,901	242,656
Value	$4,502,000	$372,000	$18,000	$90,000	$81,000	$5,063,000
Per cent	88.9	7.3	0.4	1.8	1.6	100.0
1908:						
M feet	208,311	16,494	594	13,102	975	239,476
Value	$3,944,000	$327,000	$13,000	$246,000	$22,000	$4,552,000
Per cent	86.6	7.2	0.3	5.4	0.5	100.0
1909:						
M feet	175,494	15,137	806	13,144	1,357	205,938
Value	$3,812,000	$341,000	$19,000	$277,000	$33,000	$4,482,000
Per cent	85.1	7.6	0.4	6.2	0.7	100.0
1910:						
M feet	224,635	33,284	3,053	30,189	933	292,094
Value	$5,188,000	$799,000	$76,000	$685,000	$24,000	$6,772,000
Per cent	76.6	11.8	1.1	10.1	0.4	100.0
1911:						
M feet	211,067	31,927	2,035	42,782	3,731	291,542
Value	$4,742,000	$747,000	$50,000	$959,000	$97,000	$6,595,000
Per cent	71.9	11.3	0.8	14.5	1.5	100.0
1912:						
M feet	216,198	31,206	5,809	22,430	2,586	278,229
Value	$4,667,000	$676,000	$155,000	$472,000	$70,000	$6,040,000
Per cent	77.3	11.2	2.6	7.8	1.1	100.0
1913:						
M feet	244,860	35,404	4,537	33,326	2,332	320,459
Value	$5,753,000	$832,000	$114,000	$769,000	$63,000	$7,531,000
Per cent	76.4	11.0	1.4	10.4	0.8	100.0

TABLE VII.—TOTAL EXPORTS FROM SWEDEN OF PINE AND SPRUCE PLANKS, BATTENS, BOARDS, STAVES, MOLDING STOCK, BOX SHOOKS, ETC., PLANED AND ROUGH, IN 1913 AND 1918, BY PRINCIPAL COUNTRIES OF DESTINATION.

Countries.	1913	1918	Countries.	1913	1918
	M feet.	*M feet.*		*M feet.*	*M feet.*
United Kingdom	693,673	501,744	European and Asiatic Turkey	6,386	.....
France	392,893	21,212	Algeria, Tunis, and Morocco	53,757	547
Germany	257,430	107,918	Egypt	16,973	.....
Denmark	211,777	284,841	British South Africa	70,442	18,578
Netherlands	127,003	312,646	Other countries in Africa	25,691	.....
Belgium	79,794	.....	Australia	41,826	.....
Spain	71,021	2,237	South America	12,365	1,665
Norway	76,181	171,777	Other countries	21,234	3,348
Portugal	9,365	362			
Italy	4,239	50	Total	2,175,093	1,426,925
Greece	3,043	.....			

TABLE VIII.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE PLANKS, BATTENS, AND BOARDS, PLANED AND ROUGH, BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918.

	1903	1904	1905	1906	1907	1908	1909	1910
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	770,572	638,766	690,626	702,219	567,771	528,412	439,505	530,937
France	326,953	331,337	329,320	324,027	301,518	303,882	294,006	322,651
Germany	231,444	255,004	284,716	324,324	271,553	220,855	223,883	281,008
Denmark	154,581	149,367	160,778	197,620	204,340	141,507	144,288	162,152
Netherlands	181,936	169,118	185,566	176,689	111,646	132,937	97,822	109,678
Belgium	86,562	64,209	66,326	67,106	67,070	55,252	49,401	61,982
Spain	47,476	44,083	43,738	46,397	69,488	56,165	40,873	52,571
Norway	41,376	58,398	42,887	43,263	30,870	37,254	36,677	38,028
Portugal	6,633	10,488	9,377	12,510	7,956	10,039	8,072	8,053
Italy	3,085	3,095	3,019	6,417	5,435	5,000	8,633	6,738
Greece	1,501	2,030	2,111	2,218	3,124	2,920	2,123	2,289
European and Asiatic Turkey	87	.....	34	192	315	30	333	1,974
Algiers, Tunis, and Morocco	9,312	10,846	14,018	11,468	6,146	16,921	14,858	19,952
Egypt	13,086	21,628	20,600	25,508	34,230	27,526	9,918	19,022
British South Africa	143,695	33,908	34,602	36,525	25,738	31,838	26,752	73,668
Other countries in Africa	31,898	12,866	20,325	12,625	11,621	14,454	20,378	27,389
Australia	4,200	10,054	6,566	11,559	10,145	21,331	17,422	42,089
South America	1,507	1,321	3,914	7,510	7,108	5,390	4,055	6,807
Other countries	2,831	2,061	3,556	4,259	4,063	4,288	3,281	3,536
Total	2,058,735	1,818,579	1,922,079	2,012,436	1,740,137	1,616,001	1,442,280	1,770,524

	1911	1912	1913	1914	1915	1916	1917	1918
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	476,966	512,947	564,701	652,752	984,781	855,714	323,415	386,534
France	322,813	364,318	383,540	131,961	98,398	293,430	33,080	19,513
Germany	300,604	304,579	246,158	170,001	85,088	44,425	76,145	104,578
Denmark	177,394	187,890	205,369	191,131	203,665	274,741	229,522	277,944
Netherlands	86,649	100,164	114,898	130,551	265,076	275,737	278,689	303,965
Belgium	74,493	71,326	65,344	22,792	.....	33	.....	.....
Spain	68,734	70,359	70,976	73,321	104,574	92,224	3,514	2,237
Norway	41,416	59,083	69,089	80,626	119,996	170,335	168,217	151,581
Portugal	8,179	7,562	9,365	7,150	5,637	3,661	.....	362
Italy	7,518	5,340	4,139	3,748	2,798	271	67	50
Greece	4,732	2,974	3,044	2,176	.....	.....	.....	.....
European and Asiatic Turkey	3,936	6,239	6,134	2,105	.....	.....	.....	.....
Algiers, Tunis, and Morocco	27,744	33,545	53,266	15,616	5,594	2,245	.....	546
Egypt	28,439	33,074	16,704	5,645	851	661	.....	.....
British South Africa	51,391	50,971	65,724	29,221	17,840	27,375	15,460	16,054
Other countries in Africa	23,607	16,074	25,625	11,825	4,045	1,928	1,016	.....
Australia	50,599	27,805	38,752	22,414	4,790	.....	.....	.....
South America	14,183	18,113	10,866	5,661	536	194	.....	343
Other countries	5,736	4,435	5,622	4,562	2,610	5,964	3,451	1,677
Total	1,775,133	1,876,798	1,959,316	1,563,258	1,906,279	2,048,938	1,132,576	1,265,384

TABLE IX.—EXPORTS FROM SWEDEN IN 1913 OF PINE AND SPRUCE PLANKS, BATTENS, AND BOARDS, PLANED AND ROUGH, BY SHIPPING DISTRICTS.

Shipping districts.	Rough lumber.											
	Planks.			Battens.			Scantlings.			Boards, 8½ inches and wider.		
	Pine.	Spruce.	Total.	Pine	Spruce.	Total.	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
Haparanda, Lulea, Pitea, and Skelleftea district	53,664	5,292	58,956	50,473	13,113	63,586	22,218	12,117	34,335	9,778	1,238	11,016
Haparanda	24,400	1,845	26,245	23,617	3,952	27,569	9,787	2,811	12,598	5,112	507	5,619
Lulea	847	449	1,296	2,522	835	3,357	451	326	777	45	.....	45
Pitea	11,371	620	11,991	8,698	1,594	10,292	3,595	706	4,301	1,901	219	2,120
Skelleftea	17,046	2,378	19,424	15,636	6,732	22,368	8,385	8,274	16,659	2,720	512	3,232
Umea and Ornskoldsvik district	18,253	5,047	23,300	22,132	14,911	37,043	8,302	5,306	13,608	1,530	556	2,086
Umea	14,028	2,788	16,816	16,535	7,090	23,625	5,548	3,077	8,625	1,269	271	1,540
Ornskoldsvik	4,225	2,259	6,484	5,597	7,821	13,418	2,754	2,229	4,983	261	285	546
Hernosand district (Hernosand)	24,861	20,394	45,255	25,413	51,404	76,817	11,571	25,342	36,913	3,358	3,053	6,411
Sundsvall district (Sundsvall)	29,626	11,854	41,480	24,989	38,729	63,718	15,642	25,940	41,582	5,649	2,326	7,975
Hudiksvall, Soderhamn, and Gevle district	54,053	16,851	70,904	55,190	36,697	91,887	18,538	12,578	31,116	10,661	1,747	12,408
Hudiksvall	6,124	4,700	10,824	6,932	9,662	16,594	2,045	2,021	4,066	1,659	558	2,217
Soderhamn	20,542	4,912	25,454	17,972	11,779	29,751	8,082	6,116	14,198	3,112	853	3,965
Gevle	27,387	7,239	34,626	30,286	15,256	45,542	8,411	4,441	12,852	5,890	336	6,226
Stockholm-Malmo district	32,748	13,279	46,027	28,658	13,242	41,900	12,070	3,601	15,671	11,917	3,883	15,800
Stockholm	6,716	2,774	9,490	5,544	3,932	9,476	1,690	453	2,143	1,574	223	1,797
Norrkoping	12,062	2,342	14,404	12,260	2,888	15,148	5,461	1,245	6,706	1,891	1,043	2,934
Vestervik	3,437	1,104	4,541	4,730	1,350	6,080	2,562	881	3,443	1,447	91	1,538
Oskarshamn	1,366	1,322	2,688	766	435	1,201	176	59	235	2,792	693	3,485
Kalmar	2,459	2,352	4,811	1,986	1,154	3,140	295	249	544	778	536	1,314
Visby	2,281	281	2,562	618	114	732	81	23	104	2	2	4
Karlskrona	762	1,433	2,195	1,188	2,615	3,803	423	505	928	103	93	196
Malmo	3,665	1,671	5,336	1,566	754	2,320	1,382	186	1,568	3,330	1,202	4,532
West coast district	26,013	6,148	32,161	17,479	3,660	21,139	9,402	2,381	11,783	4,020	1,488	5,508
Helsingborg	1,214	390	1,604	445	128	573	566	41	607	1,538	667	2,205
Goteborg	23,720	4,865	28,585	13,468	1,451	14,919	7,708	1,974	9,682	1,574	661	2,235
Karlstad	1,079	893	1,972	3,566	2,081	5,647	1,128	366	1,494	908	160	1,068
Districts bordering Norway	4,233	3,600	7,833	9,830	6,993	16,823	6,403	2,857	9,260	689	1,140	1,829
Other districts	3,001	2,516	5,517	3,009	1,562	4,571	1,295	619	1,914	1,263	661	1,924
Total	246,452	84,981	331,433	237,173	180,311	417,484	105,441	90,741	196,182	48,865	16,092	64,957

Shipping districts.	Rough lumber—Continued.									Planed lumber.		
	Boards, 6–8½ inches wide.			Narrow boards, less than 6 inches wide.			Total rough lumber.			Boards, 8½ inches and wider.		
	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.
	Mfeet.	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*
Haparanda, Lulea, Pitea, and Skelleftea district	31,162	4,953	36,115	41,052	15,253	56,305	208,347	51,966	260,313	34	6	40
Haparanda	14,398	1,839	16,237	19,883	5,858	25,741	97,197	16,812	114,009	.....	.....	.....
Lulea	.....	.....	.....	115	21	136	3,980	1,631	5,611	.....	.....	.....
Pitea	7,332	867	8,199	9,442	1,833	11,275	42,339	5,839	48,178	.....	.....	.....
Skelleftea	9,432	2,247	11,679	11,612	7,541	19,153	64,831	27,684	92,515	34	6	40
Umea and Ornskoldsvik district	8,907	4,421	13,328	16,988	15,818	32,806	76,112	46,059	122,171	1,962	2,417	4,379
Umea	6,076	1,243	7,319	11,432	6,011	17,443	54,888	20,480	75,368	1,641	2,039	3,680
Ornskoldsvik	2,831	3,178	6,009	5,556	9,807	15,363	21,224	25,579	46,803	321	378	699
Hernosand district (Hernosand)	15,325	14,529	29,854	29,874	44,554	74,428	110,402	159,276	269,678	140	253	393
Sundsvall district (Sundsvall)	12,788	9,247	22,035	30,563	49,199	79,762	119,257	137,295	256,552	1,057	2,871	3,928
Hudiksvall, Soderhamn, and Gevle district	45,941	16,865	62,806	72,708	44,151	116,859	257,091	128,889	385,980	3,314	2,840	6,154
Hudiksvall	5,435	2,837	8,272	10,323	11,995	22,318	32,518	31,773	64,291	475	324	799
Soderhamn	16,956	4,667	21,623	28,189	13,612	41,801	94,853	41,939	136,792	1,176	1,342	2,518
Gevle	23,550	9,361	32,911	34,196	18,544	52,740	129,720	55,177	184,897	1,663	1,174	2,837
Stockholm–Malmo district	24,399	12,008	36,407	25,261	13,139	38,400	135,053	59,152	194,205	609	1,220	1,829
Stockholm	2,748	1,148	3,896	2,859	1,524	4,383	21,131	10,054	31,185	249	103	352
Norrkoping	2,443	917	3,360	2,356	841	3,197	36,473	9,276	45,749	138	358	496
Vestervik	1,831	366	2,197	3,003	897	3,900	17,010	4,689	21,699	.....	437	437
Oskarshamn	8,042	3,237	11,279	5,692	2,108	7,800	18,834	7,854	26,688	.....	.....	.....
Kalmar	2,696	2,255	4,951	1,865	1,281	3,146	10,079	7,827	17,906	.....	63	63
Visby	12	.....	12	.....	.....	.....	2,994	420	3,414	.....	.....	.....
Karlskrona	1,089	901	1,990	2,069	1,546	3,615	5,634	7,093	12,727	.....	.....	.....
Malmo	5,538	3,184	8,722	7,417	4,942	12,359	22,898	11,939	34,837	222	259	481
West coast district	13,116	4,901	18,017	19,567	4,950	24,517	89,597	23,528	113,125	939	2,268	3,207
Helsingborg	2,641	659	3,300	3,049	1,010	4,059	9,453	2,895	12,348	427	293	720
Goteborg	2,130	734	2,864	6,454	412	6,866	55,054	10,097	65,151	512	1,857	2,369
Karlstad	8,345	3,508	11,853	10,064	3,528	13,592	25,090	10,536	35,626	.....	118	118
Districts bordering Norway	1,298	364	1,662	3,362	1,841	5,203	25,815	16,795	42,610	1,148	451	1,599
Other districts	4,417	1,932	6,349	2,776	1,388	4,164	15,761	8,678	24,439	20	.....	20
Total	157,353	69,220	226,573	242,151	190,293	432,444	1,037,435	631,638	1,669,073	9,223	12,326	21,549

TABLE IX.—EXPORTS FROM SWEDEN IN 1913 OF PINE AND SPRUCE PLANKS, BATTENS AND BOARDS, PLANED AND ROUGH, BY SHIPPING DISTRICTS—Continued.

Shipping districts.	Planed lumber—Continued.									Grand total rough and planed lumber.		
	Boards, 6–8½ inches wide.			Boards, less than 6 inches wide.			Total planed lumber.					
	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.
	Mfeet.	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*	*Mfeet.*
Haparanda, Lulea, Pitea, and Skelleftea district	987	35	1,022	318	81	399	1,339	122	1,461	209,686	52,088	261,774
Haparanda	37	.....	37	116	67	183	153	67	220	97,350	16,879	114,229
Lulea	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,980	1,631	5,611
Pitea	.....	.....	.....	.....	.....	.....	.....	.....	.....	42,339	5,839	48,178
Skelleftea	950	35	985	202	14	216	1,186	55	1,241	66,017	27,739	93,756
Umea and Ornskoldsvik district	11,868	12,448	24,316	5,072	6,367	11,439	18,902	21,232	40,134	95,014	67,291	162,305
Umea	9,027	9,025	18,052	3,912	4,371	8,283	14,580	15,435	30,015	69,468	35,915	105,383
Ornskoldsvik	2,841	3,423	6,264	1,160	1,996	3,156	4,322	5,797	10,119	25,546	31,376	56,922
Hernosand district (Hernosand)	1,893	2,831	4,724	2,364	1,604	3,968	4,397	4,688	9,085	114,799	163,964	278,763
Sundsvall district (Sundsvall)	24,391	27,981	52,372	10,486	14,218	24,704	35,934	45,070	81,004	155,191	182,365	337,556
Hudiksvall, Soderhamn, and Gevle district	19,066	16,927	35,993	14,259	4,351	18,610	36,639	24,118	60,757	293,730	153,007	446,737
Hudiksvall	6,112	6,645	12,757	3,639	1,740	5,379	10,226	8,709	18,935	42,744	40,482	83,226
Soderhamn	7,070	6,116	13,186	4,031	1,645	5,676	12,277	9,103	21,380	107,130	51,042	158,172
Gevle	5,884	4,166	10,050	6,589	966	7,555	14,136	6,306	20,442	143,856	61,483	205,339
Stockholm-Malmo district	9,914	5,675	15,589	8,937	7,447	16,384	19,460	14,342	33,802	154,513	73,494	228,007
Stockholm	255	259	514	350	398	748	854	760	1,614	21,985	10,814	32,799
Norrkoping	4,173	.....	4,173	.....	.....	.....	4,311	358	4,669	40,784	9,634	50,418
Vestervik	732	342	1,074	1,352	249	1,601	2,084	1,028	3,112	19,094	5,717	24,811
Oskarshamn	65	.....	65	190	.....	190	255	.....	255	19,089	7,854	26,943
Kalmar	20	120	140	41	.....	41	61	183	244	10,140	8,010	18,150
Visby	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,994	420	3,414
Karlskrona	.....	.....	.....	41	112	153	41	112	153	5,675	7,205	12,880
Malmo	4,669	4,954	9,623	6,963	6,688	13,651	11,854	11,901	23,755	34,752	23,840	58,592
West coast district	13,552	8,905	22,457	8,959	3,478	12,437	23,450	14,651	38,101	113,047	38,179	151,226
Helsingborg	2,023	758	2,781	4,459	1,661	6,120	6,909	2,712	9,621	16,362	5,607	21,969
Goteborg	11,462	7,862	19,324	4,423	1,611	6,034	16,397	11,330	27,727	71,451	21,427	92,878
Karlstad	67	285	352	77	206	283	144	609	753	25,234	11,145	36,379
Districts bordering Norway	1,253	2,993	4,246	6,276	8,454	14,730	8,677	11,898	20,575	34,492	28,693	63,185
Other districts	85	2,047	2,132	1,978	1,194	3,172	2,083	3,241	5,324	17,844	11,919	29,763
Total	83,009	79,842	162,851	58,649	47,194	105,843	150,881	139,362	290,243	1,188,316	771,000	1,959,316

TABLE X.—EXPORTS FROM SWEDEN IN 1913 OF PINE AND SPRUCE PLANKS, BATTENS, AND BOARDS, PLANED AND ROUGH, BY COUNTRIES OF DESTINATION.

Countries of destination.	Rough lumber.								
	Planks, 2 inches and more thick and 8½ inches and more wide.			Battens, 2 inches and more thick and 6–8½ inches wide.			Scantlings, 2 inches and more thick and less than 6 inches wide.		
	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	72,854	13,549	86,403	100,390	41,867	142,257	48,512	23,410	71,922
France	49,116	45,530	94,646	63,116	46,811	109,927	10,626	19,655	30,281
Germany	8,599	6,007	14,606	9,456	43,776	53,232	7,421	26,172	33,593
Denmark	8,104	3,186	11,290	7,001	1,453	8,454	7,758	659	8,417
Netherlands	604	3,049	3,653	6,688	30,327	37,015	1,744	14,674	16,418
Belgium	2,572	99	2,671	4,259	701	4,960	1,346	939	2,285
Spain	17,064	2,566	19,630	17,476	5,467	22,943	3,233	394	3,627
Norway	8,045	4,362	12,407	11,652	7,058	18,710	6,659	2,920	9,579
Portugal	8,411	.....	8,411	851	8	859	.....	.....	.....
Italy	2,602	.....	2,602	768	.....	768	85	.....	85
Greece	65	.....	65	307	.....	307	687	.....	687
European and Asiatic Turkey	143	.....	143	539	24	563	144	44	188
Algeria, Tunis, and Morocco	14,462	4,437	18,899	5,342	784	6,126	6,176	352	6,528
Egypt	4,673	.....	4,673	2,928	.....	2,928	2,002	.....	2,002
British South Africa	32,987	150	33,137	3,513	253	3,766	5,190	147	5,337
Portuguese East Africa	7,266	194	7,460	252	.....	252	1,691	.....	1,691
French West Africa	1,117	456	1,573	.....	.....	.....	.....	.....	.....
Other countries in Africa	2,651	79	2,730	192	164	356	1,630	665	2,295
Australia	3,164	.....	3,164	1,998	.....	1,998	216	.....	216
South America	942	1,293	2,235	2	1,588	1,590	28	552	580
Other countries	1,011	24	1,035	443	30	473	293	158	451
Total	246,452	84,981	331,433	237,173	180,311	417,484	105,441	90,741	196,182

Countries of destination.	Rough lumber—Continued.								
	Boards, less than 2 inches thick and 8½ inches and more wide.			Boards, less than 2 inches thick and 6 to 8½ inches wide.			Narrow boards, less than 2 inches thick and less than 6 inches wide.		
	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	10,092	3,408	13,500	34,894	8,771	43,665	41,816	20,095	61,911
France	7,776	2,301	10,077	20,903	6,134	27,037	54,628	56,571	111,199
Germany	6,304	2,441	8,745	26,443	20,747	47,190	39,269	46,617	85,886
Denmark	9,708	3,608	13,316	48,338	14,854	63,192	44,774	20,125	64,899
Netherlands	263	2,209	2,472	1,734	11,963	13,697	4,859	25,102	29,961
Belgium	2,588	210	2,798	6,437	1,164	7,601	29,902	15,127	45,029
Spain	1,146	87	1,233	8,665	1,162	9,827	11,015	2,297	13,312
Norway	636	624	1,260	1,626	396	2,022	3,570	1,816	5,386
Portugal	.....	.....	.....	53	.....	53	42	.....	42
Italy	248	.....	248	186	.....	186	250	.....	250
Greece	89	.....	89	743	.....	743	842	.....	842
European and Asiatic Turkey	117	49	166	457	.....	457	51	26	77
Algeria, Tunis, and Morocco	5,193	552	5,745	4,174	149	4,323	7,409	438	7,847
Egypt	3,144	.....	3,144	1,372	.....	1,372	544	.....	544
British South Africa	687	14	701	324	24	348	1,665	14	1,679
Portuguese East Africa	271	.....	271	.....	.....	.....	515	.....	515
Other countries in Africa	368	404	772	263	123	386	489	87	576
Australia	32	.....	32	12	.....	12	25	.....	25
South America	42	87	129	73	3,427	3,500	.....	1,715	1,715
Other countries	161	98	259	656	306	962	486	263	749
Total	48,865	16,092	64,957	157,353	69,220	226,573	242,151	190,293	432,444

TABLE X.—EXPORTS FROM SWEDEN IN 1913 OF PINE AND SPRUCE, PLANKS, BATTENS, AND BOARDS, PLANED AND ROUGH, BY COUNTRIES OF DESTINATION—Con.

Countries of destination.	Rough lumber—Continued.			Planed lumber.					
	Total rough stock.			8½ inches and wider.			6 to 8½ inches wide.		
	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	308,558	111,100	419,658	6,922	10,040	16,962	43,653	38,729	82,382
France	206,165	177,002	383,167	18	8	26	109	93	202
Germany	97,492	145,760	243,252	41	51	92	1,083	1,038	2,121
Denmark	125,683	43,885	169,568	650	616	1,266	6,855	6,817	13,672
Netherlands	15,892	87,324	103,216	10	146	156	71	5,853	5,924
Belgium	47,104	18,240	65,344	.....	.....	.....	.....	.....	.....
Spain	58,599	11,973	70,572	.....	.....	.....	132	.....	132
Norway	32,188	17,176	49,364	1,162	447	1,609	1,430	2,426	3,856
Portugal	9,357	8	9,365	.....	.....	.....	.....	.....	.....
Italy	4,139	.....	4,139	.....	.....	.....	.....	.....	.....
Greece	2,733	.....	2,733	.....	.....	.....	10	.....	10
European and Asiatic Turkey	1,451	143	1,594	37	.....	37	368	.....	368
Algeria, Tunis, and Morocco	42,756	6,712	49,468	.....	.....	.....	646	523	1,169
Egypt	14,663	.....	14,663	.....	.....	.....	59	.....	59
British South Africa	44,366	602	44,968	121	.....	121	17,576	1,606	19,182
Portuguese East Africa	9,995	194	10,189	.....	.....	.....	3,505	.....	3,505
French West Africa	1,117	456	1,573	.....	.....	.....	.....	.....	.....
Other countries in Africa	5,593	1,522	7,115	10	18	28	919	170	1,089
Australia	5,447	.....	5,447	212	990	1,202	5,989	21,613	27,602
South America	1,087	8,662	9,749	.....	8	8	303	762	1,065
Other countries	3,050	879	3,929	41	2	42	301	212	513
Total	1,037,435	631,638	1,669,073	9,223	12,326	21,549	83,009	79,842	162,851

Countries of destination.	Planed lumber—Continued.						Grand total rough and planed lumber.		
	Less than 6 inches wide.			Total planed boards.					
	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	26,186	19,513	45,699	76,761	68,282	145,043	385,319	179,382	564,701
France	145	.....	145	272	101	373	206,437	177,103	383,540
Germany	539	154	693	1,663	1,243	2,906	99,155	147,003	246,158
Denmark	11,646	9,217	20,863	19,151	16,650	35,801	144,834	60,535	205,369
Netherlands	212	5,390	5,602	293	11,389	11,682	16,185	98,713	114,898
Belgium	.....	.....	.....	.....	.....	.....	47,104	18,240	65,344
Spain	232	40	272	364	40	404	58,963	12,013	70,976
Norway	6,245	8,015	14,260	8,837	10,888	19,725	41,025	28,064	69,089
Portugal	.....	.....	.....	.....	.....	.....	9,357	8	9,365
Italy	.....	.....	.....	.....	.....	.....	4,139	.....	4,139
Greece	289	12	301	299	12	311	3,032	12	3,044
European and Asiatic Turkey	4,008	127	4,135	4,413	127	4,540	5,864	270	6,134
Algeria, Tunis, and Morocco	2,316	313	2,629	2,962	836	3,798	45,718	7,548	53,266
Egypt	1,982	.....	1,982	2,041	.....	2,041	16,704	.....	16,704
British South Africa	1,374	79	1,453	19,071	1,685	20,756	63,437	2,287	65,724
Portuguese East Africa	503	.....	503	4,008	.....	4,008	14,003	194	14,197
French West Africa	.....	.....	.....	.....	.....	.....	1,117	456	1,573
Other countries in Africa	1,328	295	1,623	2,257	483	2,740	7,350	2,005	9,855
Australia	1,097	3,404	4,501	7,298	26,007	33,305	12,745	26,007	38,752
South America	.....	44	44	303	814	1,117	1,390	9,476	10,866
Other countries	547	591	1,138	888	805	1,693	3,938	1,684	5,622
Total	58,649	47,191	105,843	150,881	139,362	290,243	1,188,316	771,000	1,959,316

TABLE XI.—EXPORTS FROM SWEDEN IN 1918 OF PINE AND SPRUCE PLANKS, BATTENS, AND BOARDS, PLANED AND ROUGH, BY COUNTRIES OF DESTINATION.

Countries of destination.	Rough lumber.								
	Planks, 2 inches and more thick and 8½ inches and more wide.			Battens, 2 inches and more thick and 6–8½ inches wide.			Scantlings, 2 inches and more thick and less than 6 inches wide.		
	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	79,576	25,564	105,140	90,474	45,088	135,562	39,135	23,039	62,174
France	3,404	1,239	4,643	3,481	1,426	4,907	1,863	1,245	3,108
Germany	1,338	499	1,837	3,764	10,876	14,640	2,580	6,071	8,651
Denmark	9,381	1,796	11,177	13,662	1,776	15,438	11,506	776	12,282
Netherlands	4,993	20,246	25,239	21,837	79,436	101,273	10,124	37,739	47,863
Spain	1,119	172	1,291	536	41	577	141	.....	141
Norway	11,290	4,889	16,179	23,526	11,371	34,897	24,421	12,482	36,903
Portugal	362	.....	362	.....	.....	.....	.....	.....	.....
Italy	50	.....	50	.....	.....	.....	.....	.....	.....
Algeria, Tunis, and Morocco	182	.....	182	166	.....	166	.....	.....	.....
Egypt	.....	.....	.....	.....	.....	.....	.....	.....	.....
British South Africa	8,607	.....	8,607	2,047	18	2,065	1,073	20	1,093
South America	.....	.....	.....	.....	101	101	.....	.....	.....
Other countries	22	2	24	141	10	151	180	30	210
Total	120,324	54,407	174,731	159,634	150,143	309,777	91,023	81,402	172,425

Countries of destination.	Rough lumber—Continued.								
	Boards, less than 2 inches thick and 8½ inches and more wide.			Boards, less than 2 inches thick and 6–8½ inches wide.			Narrow boards, less than 2 inches thick and less than 6 inches wide.		
	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M fee.*	*M feet.*	*M feet.*
United Kingdom	9,114	2,469	11,583	14,054	6,346	20,400	19,545	6,546	26,091
France	990	327	1,317	542	408	950	1,184	711	1,895
Germany	4,908	1,115	6,023	15,171	8,744	23,915	32,480	16,966	49,446
Denmark	12,139	1,659	13,798	83,710	7,952	91,662	75,294	20,281	95,575
Netherlands	3,150	4,884	8,034	8,942	32,054	40,996	9,215	62,891	72,106
Spain	4	.....	4	152	42	194	30	.....	30
Norway	2,657	762	3,419	4,309	1,249	5,558	13,613	9,128	22,741
Algeria, Tunis, and Morocco	61	.....	61	.....	.....	.....	.....	.....	.....
British South Africa	.....	8	8	137	.....	137	915	.....	915
South America	.....	20	20	.....	101	101	.....	121	121
Other countries	2	14	16	380	59	439	89	126	215
Total	33,025	11,258	44,283	127,397	56,955	184,352	152,365	116,770	269,135

Countries of destination.	Rough lumber—Contd.			Planed lumber.					
	Total rough lumber.			Boards 8½ inches and more wide.			Boards 6–8½ inches wide.		
	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M fect.*	*M feet.*
United Kingdom	251,898	109,052	360,950	370	590	960	10,094	4,295	14,389
France	11,464	5,356	16,820	.....	.....	.....	1,822	10	1,832
Germany	60,241	44,271	104,512	.....	.....	.....	.....	.....	.....
Denmark	205,692	34,240	239,932	206	49	255	8,940	3,095	12,035
Netherlands	58,261	237,250	295,511	.....	.....	.....	69	5,400	5,469
Spain	1,982	255	2,237	.....	.....	.....	.....	.....	.....
Norway	79,816	39,881	119,697	1,348	442	1,790	2,081	2,073	4,154
Portugal	362	.....	362	.....	.....	.....	.....	.....	.....
Italy	50	.....	50	.....	.....	.....	.....	.....	.....
Algeria, Tunis, and Morocco	409	.....	409	.....	.....	.....	.....	.....	.....
British South Africa	12,779	46	12,825	412	.....	412	2,556	.....	2,556
South America	.....	343	343	.....	.....	.....	.....	.....	.....
Other countries	814	241	1,055	8	.....	8	.....	8	8
Total	683,768	470,935	1,154,703	2,344	1,081	3,425	25,562	14,881	40,443

TABLE XI—EXPORTS FROM SWEDEN IN 1918 OF PINE AND SPRUCE PLANKS, BATTENS, AND BOARDS, PLANED AND ROUGH, BY COUNTRIES OF DESTINATION—Continued.

Countries of destination.	Planed lumber—Continued.						Grand total rough and planed lumber.		
	Narrow boards, less than 6 inches wide.			Total planed lumber.					
	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.	Pine.	Spruce.	Total.
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	7,077	3,158	10,235	17,541	8,043	25,584	269,439	117,095	386,534
France	665	196	861	2,487	206	2,693	13,951	5,562	19,513
Germany	6	60	66	6	60	66	60,247	44,331	104,578
Denmark	18,766	6,956	25,722	27,912	10,100	38,012	233,604	44,340	277,944
Netherlands	55	2,930	2,985	124	8,330	8,454	58,385	245,580	303,965
Spain							1,982	255	2,237
Norway	16,434	9,506	25,940	19,863	12,021	31,884	99,679	51,902	151,581
Portugal							362		362
Italy							50		50
Algeria, Tunis, and Morocco	137		137	137		137	546		546
British South Africa	261		261	3,229		3,229	16,008	46	16,054
South America								343	343
Other countries	135	471	606	143	479	622	957	720	1,677
Total	43,536	23,277	66,813	71,442	39,239	110,681	755,210	510,174	1,265,384

TABLE XII.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE STAVES, BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918.

Countries of destination.	1903	1904	1905	1906	1907	1908	1909	1910
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	8,148	7,134	8,663	10,989	25,585	23,558	15,525	32,593
France	2,016	5,594	2,946	3,275	2,950	1,952	3,875	4,074
Germany	4,172	3,867	4,710	5,184	3,117	2,237	1,830	2,251
Netherlands	2,289	1,350	2,154	1,883	1,916	1,940	2,558	3,505
Belgium	6,316	3,051	4,938	5,982	2,875	3,080	1,806	986
Norway	6,496	9,177	10,635	5,403	1,059	519	396	620
Denmark	313	24	962	343	1,770	1,228	1,586	1,378
Canary Islands				1,645			40	
Other countries	370			105	14	51	770	
Total	30,120	30,197	35,008	34,809	39,286	34,565	28,386	45,407

Countries of destination.	1911	1912	1913	1914	1915	1916	1917	1918
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	28,607	26,888	31,951	18,417	24,421	18,806	3,598	9,625
France	3,600	4,370	6,966	2,714		144		
Germany	3,673	5,289	5,261	2,235	552	736	792	1,958
Netherlands	2,774	3,330	4,815	4,629	5,710	5,126	1,721	253
Belgium	3,542	5,017	10,044	2,433				
Spain				4				
Norway	2,449	3,366	4,805	3,314	9,720	12,319	12,089	18,394
Denmark	1,899	5,417	3,950	5,530	11,961	13,753	851	2,140
Canary Islands	75	55	71	184				
Other countries	119		38	162	101	5,679	51	22
Total	46,738	53,732	67,901	39,622	52,465	56,563	19,102	32,392

TABLE XIII.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE LATHS, MOLDING STOCK, BROOM-HANDLE STOCK, ETC., BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918.

Countries of destination.	1903	1904	1905	1906	1907	1908	1909	1910
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	26,465	20,595	20,279	19,788	18,883	18,390	18,101	19,642
France	172	790	53	499	139	608	87	418
Germany	1,996	2,625	5,465	4,091	3,164	4,495	3,683	3,344
Netherlands	4,101	5,304	6,296	5,972	3,946	4,437	4,639	3,926
Belgium	2,992	1,356	356	784	1,081	400	236	592
Norway	28	81	12	12	10	46	26	12
Denmark	1,580	1,701	1,812	1,608	1,483	2,263	2,380	2,077
Egypt	26	18	.....	4	38	8	.....	.....
Other countries	259	195	119	174	30	79	81	38
Total	37,619	32,665	34,392	32,932	28,774	30,726	29,233	30,049

Countries of destination.	1911	1912	1913	1914	1915	1916	1917	1918
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	18,949	18,323	21,544	17,636	14,824	13,026	1,335	962
France	386	572	705	697	139	103	.....	.....
Germany	3,815	2,758	1,368	1,430	180	246	748	780
Netherlands	3,479	4,803	5,540	6,368	7,752	8,868	7,381	6,188
Belgium	297	929	1,931	495	.....	.....	.....	.....
Spain	20	44	32	57	40	10	.....	.....
Norway	4	40	85	8	412	748	196	97
Denmark	1,927	1,313	1,511	1,756	1,915	2,562	1,515	2,461
Canary Islands	16	14	137	95	.....	.....	.....	.....
Other countries	236	145	570	174	95	26	.....	.....
Total	29,129	28,941	33,423	28,716	25,357	25,589	11,175	10,488

TABLE XIV.—EXPORTS FROM SWEDEN OF BOX SHOOKS, PLANED AND ROUGH, FROM 1907 TO 1916.

Years.	Rough shooks.[a]	Planed shooks.[b]	Years.	Rough shooks.[a]	Planed shooks.[b]
1907	[c] $646,000	$345,000	1912	$2,141,000	$672,000
1908	[c] 927,000	352,000	1913	2,203,000	828,000
1909	[c] 1,244,000	353,000	1914	2,358,000	770,000
1910	[c] 1,420,000	342,000	1915	4,280,000	1,326,000
1911	[c] 1,755,000	379,000	1916	7,359,000	2,415,000

[a] Prior to 1907, included in planks, battens, and boards.
[b] Prior to 1907, included in planed lumber.
[c] Pine and spruce only.

TABLE XV.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE SAWN BOX SHOOKS, BY COUNTRIES OF DESTINATION, FROM 1907 TO 1918.

Countries of destination.	1907	1908	1909	1910	1911	1912
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	22,865	24,999	26,637	32,827	32,110	39,000
France	820	1,071	1,172	1,090	529	909
Germany	2,689	4,409	2,964	5,514	3,778	5,423
Netherlands	794	1,471	584	640	1,008	2,894
Belgium	2,309	2,882	5,227	4,481	2,492	2,746
Spain	.....	.....	.....	55	121	99
Norway	543	204	784	766	89	202
Denmark	.....	53	149	253	408	701
Canary Islands	10,019	9,163	9,025	9,068	11,306	15,086
Other countries	6,294	4,605	9,701	14,991	15,876	17,607
Total	46,333	48,857	56,243	69,685	67,717	84,667

TABLE XV.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE SAWN BOX SHOOKS, BY COUNTRIES OF DESTINATION, FROM 1907 TO 1918—Continued.

Countries of destination.	1913	1914	1915	1916	1917	1918
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	54,333	52,553	97,060	118,345	84,328	91,240
France	1,683	871	556	1,491	.....	1,699
Germany	4,396	2,396	2,097	2,926	25,615	602
Netherlands	1,748	2,229	2,891	6,273	2,604	2,239
Belgium	2,433	141	.....	.....	.....	.....
Spain	14	675	42	255	.....	.....
Norway	2,202	1,324	1,034	2,241	1,679	1,428
Denmark	659	699	806	980	1,028	2,178
Egypt	267	.....	.....	69	.....	.....
Canary Islands	11,850	11,739	11,633	11,828	311	.....
Other countries	7,504	5,725	2,519	3,891	4,017	4,372
Total	87,089	78,352	118,638	148,299	119,582	103,758

TABLE XVI.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE PLANED BOX SHOOKS, BY COUNTRIES OF DESTINATION, FROM 1907 TO 1918.

Countries of destination.	1907	1908	1909	1910	1911	1912
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	12,864	9,599	8,866	7,280	6,657	14,307
France	44	.....	137	.....	188	38
Germany	360	758	55	14	125	50
Belgium	921	.....	.....	4	.....	139
Spain	10	.....	826	.....	8	99
Norway	.....	.....	10	.....	44	.....
Denmark	.....	.....	.....	236	71	139
Canary Islands	131	1,703	6	.....	218	6
Other countries	3,849	2,596	2,934	4,208	5,166	7,361
Total	18,179	14,656	12,834	11,742	12,477	22,139

Countries of destination.	1913	1914	1915	1916	1917	1918
	M feet.	*M feet.*	*M feet.*	*M feet.*	*M feet.*	*M feet.*
United Kingdom	21,144	18,227	29,058	40,376	25,158	13,383
France	.....	131	.....	1,172	53	.....
Germany	246	20	.....	.....	2,125	.....
Netherlands	.....	8	.....	61	.....	.....
Belgium	42	.....	.....	.....	.....	.....
Norway	.....	232	.....	224	196	277
Denmark	289	59	59	.....	.....	117
Egypt	.....	42	42	.....	.....	.....
Canary Islands	26	6	.....	.....	.....	.....
Other countries	5,516	2,002	2,299	1,832	1,220	1,125
Total	27,263	20,727	31,458	43,665	28,752	14,902

TABLE XVII.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE SPLIT WOOD (MILL ENDS), BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918.

Countries of destination.	1903	1904	1905	1906	1907	1908	1909	1910
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
United Kingdom	12,148,000	12,658,000	11,712,000	12,189,000	10,477,000	8,471,000	8,062,000	7,629,000
France	57,000	54,000	73,000	45,000	33,000	19,000	2,000	49,000
Germany	216,000	361,000	75,000	184,000	100,000	23,000	117,000	214,000
Netherlands	143,000	78,000	143,000	266,000	253,000	257,000	544,000	616,000
Belgium	144,000	61,000	126,000	380,000	64,000	57,000	89,000	103,000
Spain	10,000	8,000	24,000	28,000	17,000	19,000	9,000	10,000
Norway	6,000	41,000	62,000	78,000	130,000	120,000	255,000	272,000
Denmark	1,564,000	1,510,000	1,250,000	1,591,000	1,154,000	1,218,000	1,189,000	1,295,000
Other countries	14,000	6,000	16,000	29,000	66,000	71,000	49,000	214,000
Total	14,302,000	14,777,000	13,481,000	14,790,000	12,294,000	10,258,000	10,316,000	10,402,000

TABLE XVII.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE SPLIT WOOD (MILL ENDS), BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918—Continued.

Countries of destination.	1911	1912	1913	1914	1915	1916	1917	1918
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
United Kingdom	8,419,000	8,371,000	10,513,000	5,592,000	152,000	176,000	7,000	.....
France	23,000	37,000	8,000	6,000	.....	.....	.....	.....
Germany	282,000	196,000	82,000	58,000	33,000	27,000	.....	.....
Netherlands	538,000	445,000	491,000	388,000	448,000	440,000	126,000	2,000
Belgium	35,000	23,000	111,000	.....	.....	.....	.....	.....
Spain	6,000	5,000	4,000	4,000	.....	.....	.....	.....
Norway	410,000	440,000	753,000	723,000	1,537,000	1,001,000	423,000	45,000
Denmark	1,364,000	1,371,000	1,710,000	1,357,000	1,357,000	1,235,000	1,665,000	1,139,000
Other countries	45,000	122,000	43,000	14,000	.....	.....	.....	.....
Total	11,122,000	11,010,000	13,715,000	8,142,000	3,527,000	2,879,000	2,221,000	1,186,000

TABLE XVIII.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE ROUND TIMBER, ETC., $9\frac{27}{32}$ INCHES AND MORE IN TOP DIAMETER, BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918.

Years.	United Kingdom	France.	Germany.	Netherlands.	Norway.	Denmark.	Other countries.	Total.
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
1903	24,675	7,484	3,812	561,835	3,814,059	114,619	.....	4,526,484
1904	24,710	.....	6,425	313,464	1,422,307	335,950	.....	2,102,856
1905	.....	.....	4,271	524,064	644,684	160,227	176	1,333,422
1906	.....	.....	177	509,238	1,151,415	227,544	600	1,888,974
1907	3,742	.....	.....	82,920	3,210,747	169,616	237,887	3,704,912
1908	530	.....	.....	113,701	526,041	244,452	4,942	889,666
1909	2,224	.....	141	21,851	511,850	112,254	17,403	665,723
1910	1,730	282	2,365	.....	538,678	294,896	35	837,986
1911	.....	.....	1,377	30,217	404,397	68,375	988	505,354
1912	3,389	4,236	.....	44,160	772,646	49,950	71	874,452
1913	23,545	1,553	1,059	23,298	1,043,362	84,720	46,243	1,223,780
1914	17,332	565	.....	.....	228,779	37,877	.....	284,553
1915	27,746	.....	7,236	206,717	1,160,382	41,583	1,659	1,445,323
1916	4,201	.....	.....	142,930	4,081,598	20,544	1,694	4,250,967
1917	.....	.....	.....	146,707	599,005	12,567	.....	758,279
1918	.....	.....	.....	.....	963,443	14,508	[a] 1,236	979,187

[a] To Spain.

TABLE XIX.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE ROUND TIMBER, $1\frac{31}{32}$ TO $9\frac{27}{32}$ INCHES IN TOP DIAMETER, BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918.

Countries of destination.	1903	1904	1905	1906	1907	1908	1909	1910
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
United Kingdom	349,329	197,045	118,785	303,968	347,564	464,442	617,291	567,448
France	23,792	37,312	40,630	27,216	24,216	43,489	26,404	29,617
Germany	16,979	25,557	27,181	15,109	5,895	1,694	5,366	.....
Netherlands	1,265,682	973,362	1,347,189	1,170,972	672,712	548,526	1,099,030	698,410
Spain	2,824	4,448	1,306	.....	.....	1,412	1,271	.....
Norway	2,258,847	4,325,097	3,098,493	4,888,732	2,937,631	5,444,495	4,993,185	4,709,020
Denmark	1,143,332	737,135	846,247	395,042	490,811	582,379	559,717	94,392
Egypt	36,606	14,402	18,921	5,507	.....	.....	2,542	4,624
Canary Islands	.....	.....	.....	.....	.....	.....	35	.....
Other countries	34,064	18,215	8,154	10,731	4,236	50,514	32,970	13,167
Total	5,131,455	6,332,573	5,506,906	6,817,277	4,483,065	7,136,951	7,337,811	6,116,678

TABLE XIX.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE ROUND TIMBER, $1\frac{3}{32}$ TO $9\frac{27}{32}$ INCHES IN TOP DIAMETER, BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918—Continued.

Countries of destination.	1911	1912	1913	1914	1915	1916	1917	1918
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
United Kingdom	375,980	524,487	675,254	516,792	180,736	26,157	11,649	92,092
France	26,616	16,414	25,063	24,639	.....	.....	.....	.....
Germany	71	33,888	671	35	.....	.....	.....	.....
Netherlands	406,762	628,870	586,898	667,700	282,612	150,272	38,724	130,232
Norway	5,324,369	3,579,738	3,348,311	6,491,282	4,169,812	4,446,141	5,759,972	5,133,482
Denmark	176,359	791,744	113,242	113,772	68,729	54,609	18,144	26,828
Egypt	.....	8,543	15,497	.....	.....	.....	.....	.....
Canary Islands	.....	.....	141	247	.....	.....	.....	.....
Other countries	11,755	6,742	18,638	5,612	7,590	10,061	565	388
Total	6,321,912	5,593,426	4,783,715	7,820,079	4,709,479	4,687,240	5,829,054	5,382,968

TABLE XX.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE HEWN TIMBER, $7\frac{7}{8}$ INCHES AND MORE AT MIDDLE, BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918.

Countries of destination.	1903	1904	1905	1906	1907	1908	1909	1910
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
United Kingdom	114,800	109,850	58,100	130,550	145,650	134,300	88,300	87,600
France	142,200	140,250	118,500	176,250	140,650	145,050	80,700	92,250
Germany	248,350	238,200	245,100	457,800	408,700	258,750	269,350	297,750
Netherlands	117,150	.....	11,300	30,650	.....	.....	.....	.....
Belgium	.....	350	.....	.....	.....	.....	.....	600
Spain	90,000	38,150	85,200	100,800	60,350	90,100	65,550	51,150
Norway	25,200	69,700	98,550	54,350	16,850	2,150	1,750	1,100
Denmark	1,436,250	1,154,450	1,350,350	1,841,900	1,145,250	426,650	482,950	718,300
Egypt	.....	.....	.....	.....	.....	.....	6,900	.....
Other countries	16,850	50,800	12,400	51,500	11,400	2,700	.....	.....
Total	2,190,800	1,801,750	1,979,500	2,843,800	1,928,850	1,059,700	995,500	1,248,750

Countries of destination.	1911	1912	1913	1914	1915	1916	1917	1918
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
United Kingdom	72,250	42,550	76,750	25,900	31,050	409,900	24,700	.....
France	81,450	119,000	133,150	24,800	2,450	400	.....	.....
Germany	392,750	469,450	625,200	329,300	125,600	16,700	34,900	7,500
Netherlands	.....	800	2,400	.....	12,450	609,400	115,200	147,500
Belgium	3,550	.....	.....	.....	.....	.....	.....	.....
Spain	33,300	31,350	49,000	46,350	4,250	9,300	.....	.....
Norway	13,650	61,400	13,500	31,450	43,900	57,150	62,000	82,500
Denmark	1,074,300	735,000	994,300	697,450	780,350	884,300	763,400	1,302,550
Egypt	18,550	.....	.....	.....	.....	.....	.....	.....
Other countries	6,850	7,250	5,800	7,400	6,050	2,250	5,250	.....
Total	1,696,650	1,466,800	1,900,100	1,162,650	1,006,100	1,989,400	1,005,450	1,540,050

TABLE XXI.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE SMALL HEWN OR SAWN TIMBER, LESS THAN $7\frac{7}{8}$ INCHES AT MIDDLE, BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918.

Countries of destination.	1903	1904	1905	1906	1907	1908	1909	1910
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
United Kingdom	627,000	681,800	498,450	863,050	695,450	689,150	652,350	489,350
France	756,900	701,250	685,700	691,350	740,550	542,900	532,200	478,000
Germany	3,183,600	2,764,500	3,310,350	3,578,250	3,911,300	3,066,700	3,329,350	3,179,750
Netherlands	234,000	294,050	345,000	289,150	167,600	92,000	180,850	60,250
Belgium	1,750	44,550	.....	.....	.....	.....	.....	24,200
Spain	37,900	29,950	39,000	60,500	74,650	37,600	44,500	59,150
Norway	42,600	53,450	13,350	6,550	29,850	26,500	27,600	32,650
Denmark	3,046,750	2,277,050	2,822,000	3,851,400	4,190,900	3,391,800	3,343,950	3,408,700
Egypt	3,804,050	5,320,900	4,884,750	3,569,000	3,238,100	2,726,900	4,927,250	2,951,600
Other countries	96,900	42,550	92,000	308,300	76,800	65,550	156,900	394,900
Total	11,831,450	12,210,050	12,691,600	13,217,550	13,125,200	10,639,100	13,194,950	11,078,550

TABLE XXI.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE SMALL HEWN OR SAWN TIMBERS, LESS THAN 7⅞ INCHES AT MIDDLE, BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918—Continued.

Countries of destination.	1911	1912	1913	1914	1915	1916	1917	1918
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
United Kingdom	605,000	571,100	696,300	1,528,300	499,600	1,342,950	110,450	46,150
France	458,050	579,800	624,150	235,650	.....	1,350	.....	19,300
Germany	2,799,200	3,113,800	3,292,400	1,976,800	744,150	82,500	320,250	88,950
Netherlands	170,950	309,200	961,850	525,300	57,500	246,200	172,600	155,700
Belgium	9,000	.....	.....	.....	.....	.....	.....	.....
Spain	14,350	52,450	43,000	28,150	3,750	6,300	.....	.....
Norway	18,150	55,650	62,300	101,800	192,850	1,173,450	858,600	380,000
Denmark	3,324,800	3,820,350	5,355,900	5,006,500	4,546,000	5,271,300	3,707,800	5,001,750
Egypt	2,689,450	2,357,250	1,874,100	809,400	.....	.....	.....	.....
Other countries	860,900	745,400	985,800	480,250	69,400	97,400	61,950	23,750
Total	10,949,850	11,605,000	13,895,800	10,692,150	6,113,250	8,221,450	5,231,650	5,715,600

TABLE XXII.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE RAILROAD TIES, BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918.

Years.	United Kingdom.	Germany.	Netherlands.	Norway.	Denmark.	Other countries.	Total.
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
1903	1,300,946	.....	.....	47,161	4,060	.....	1,352,167
1904	1,499,932	.....	.....	50,973	2,295	.....	1,553,200
1905	2,194,495	61,952	.....	15,885	69,470	.....	2,341,802
1906	1,857,874	180,665	.....	52,421	9,743	.....	2,100,703
1907	2,165,090	.....	.....	63,363	27,005	.....	2,255,458
1908	2,758,483	3,177	.....	21,427	17,474	.....	2,800,561
1909	1,997,309	35	.....	1,271	24,498	.....	2,023,113
1910	1,666,901	.....	.....	7,519	8,754	.....	1,683,174
1911	1,528,878	.....	.....	600	15,250	.....	1,544,728
1912	2,839,850	.....	.....	2,047	20,297	[a] 424	2,862,618
1913	2,964,070	.....	.....	20,509	99,475	[b] 530	3,084,584
1914	2,432,735	.....	.....	99,934	29,511	1,165	2,563,345
1915	2,309,785	3,212	.....	44,972	572,001	.....	2,929,970
1916	2,316,139	73,071	6,954	42,960	650,579	.....	3,089,703
1917	870,110	.....	.....	23,686	269,727	.....	1,163,523
1918	188,326	.....	625,022	4,977	485,340	.....	1,303,665

[a] To Canary Islands.
[b] Including 424 cubic feet sent to Canary Islands.

TABLE XXIII.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE PIT PROPS, BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918.

Years.	United Kingdom.	France.	Germany.	Netherlands.	Norway.	Denmark.	Other countries.	Total.
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
1903	35,374,236	.....	4,624	.....	712,636	.....	.....	36,091,496
1904	37,306,064	.....	35	.....	590,781	459	.....	37,897,339
1905	25,135,330	.....	106	.....	315,900	212	8,083	25,459,631
1906	27,561,358	.....	.....	32,653	769,575	8,825	529	28,372,940
1907	23,447,001	.....	.....	.....	1,695,671	282	353	25,143,307
1908	21,730,221	3,389	.....	.....	991,330	3,777	565	22,729,282
1909	14,897,518	8,931	.....	75,613	592,405	423	4,730	15,579,620
1910	17,846,233	.....	35	9,354	256,137	.....	3,566	18,115,325
1911	17,956,369	.....	164,533	.....	369,626	141	14,191	18,504,860
1912	15,010,160	.....	122,420	.....	365,920	918	39,360	15,538,778
1913	18,798,203	.....	25,134	247	324,019	53,197	35,370	19,236,170
1914	16,605,402	.....	2,083	.....	593,746	3,459	73,248	17,277,938
1915	22,096,565	.....	.....	.....	3,722,314	8,119	1,941	25,828,939
1916	15,817,118	.....	.....	.....	1,102,419	.....	2,047	16,921,584
1917	4,208,501	.....	.....	.....	290,837	209,682	.....	4,709,020
1918	3,327,166	.....	.....	.....	146,283	563,847	.....	4,037,296

TABLE XXIV.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE PULP WOOD, BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918.

Years.	United Kingdom.	Germany.	Norway.	Denmark.	Other countries.	Total.
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
1903	.....	.....	635,153	247,771	[a] 9,354	892,278
1904	.....	.....	612,632	134,105	[a] 130,080	876,817
1905	.....	.....	340,715	69,506	.....	410,221
1906	.....	.....	348,729	17,721	[b] 49,455	415,905
1907	.....	6,460	525,970	33,888	.....	566,318
1908	.....	.....	597,346	6,566	.....	603,912
1909	.....	18,568	1,765	.....	[b] 107,029	127,362
1911 [c]	.....	.....	3,318	.....	.....	3,318
1912	1,836	.....	78,154	.....	.....	79,990
1913	918	9,707	1,248,808	.....	.....	1,259,433
1014	88,285	.....	843,246	2,471	.....	934,002
1915	199,586	.....	1,777,779	.....	.....	1,977,365
1916	.....	.....	452,228	.....	.....	452,228
1917	.....	.....	218,966	.....	.....	218,966
1918	.....	.....	40,983	.....	.....	40,983

[a] To the Netherlands. [b] To France. [c] There were no exports in 1910.

TABLE XXV.—EXPORTS FROM SWEDEN OF PINE AND SPRUCE TELEGRAPH AND TELEPHONE POLES, BY COUNTRIES OF DESTINATION, FROM 1903 TO 1918.

Years.	United Kingdom.	Germany.	Norway.	Denmark.	Egypt.	Other countries.	Total.
	Cubic feet.	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*	*Cubic feet.*
1903	45,608	2,506	.....	3,353	30,076	.....	81,543
1904	165,345	.....	.....	847	47,302	.....	213,494
1905	239,369	.....	.....	49,385	20,439	.....	309,193
1906	172,158	.....	.....	24,145	19,486	.....	215,789
1907	72,047	.....	.....	63,964	.....	.....	136,011
1908	116,949	.....	18,709	103,782	5,154	.....	244,594
1909	84,508	.....	.....	27,816	.....	.....	112,324
1910	31,734	.....	.....	27,675	1,942	.....	61,351
1911	565	.....	.....	43,948	3,530	.....	48,043
1912	13,379	199,798	3,459	147,483	.....	.....	364,119
1913	36,077	151,119	635	178,724	.....	.....	366,555
1914	374,180	144,730	66,152	227,297	.....	[a] 529	812,888
1915	2,153	15,497	5,401	359,883	.....	.....	382,934
1916	67,705	.....	26,228	287,201	.....	.....	381,134
1917	.....	.....	34,100	185,748	.....	.....	219,848
1918	.....	.....	.....	162,662	.....	[b] 69,329	231,991

[a] To France. [b] To the Netherlands.

VALUES PER UNIT GIVEN IN SWEDISH OFFICIAL STATISTICS IN 1913 FOR PINE AND SPRUCE PRODUCTS FOR EXPORT.

Hewn timber:	Per cubic foot.
Minimum diameter at middle 7⅞ inches	$0.25
Diameter 4¾–7⅞ inches	.17
Diameter less than 4¾ inches	.13
Railroad ties	.17
Firewood	.05
Round timber:	
Masts, logs, etc.—	
9⅞ inches in top diameter	.25
2–9⅞ inches in top diameter	.17
Telegraph and telephone poles	.17
Pit props	.05
Pulp wood	.08
Sawn lumber:	Per M feet.
Box shooks	25.28
Staves	15.55
Planks (minimum thickness 2 inches, minimum width 7¼ inches)—	
Pine	23.70
Spruce	21.30
Battens (minimum thickness 2 inches, width 5⅞–7¼ inches)—	
Pine	19.70
Spruce	18.75
Scantlings (minimum thickness 2 inches, width less than 5⅞ inches)—	
Pine	17.25
Spruce	16.95
Boards (less than 2 inches thick)—	
7¼ inches and more wide—	
Pine	26.30
Spruce	22.10
5⅞–7¼ inches wide—	
Pine	22.00
Spruce	19.00
Narrow boards (less than 2 inches thick and less than 5⅞ inches wide)—	
Pine	16.45
Spruce	16.00
Splitwood (maximum length 6½ feet)	4.65
Lath wood	9.48
Laths, lists, moldings, etc.	8.81
Broom handles	9.48
Planed lumber:	
Boards—	
Minimum width 7¼ inches—	
Pine	29.75
Spruce	26.40
Width 5⅞ to 7¼ inches—	
Pine	23.65
Spruce	23.00
Width less than 5⅞ inches—	
Pine	20.95
Spruce	21.65
Splitwood (maximum length 6½ feet)	6.32
Box shooks	30.33

Appendix C.—CATALOGUES.

In connection with the foregoing report, Mr. Oxholm submitted the following catalogues, all in the English language, which may be seen at the Bureau of Foreign and Domestic Commerce or its district offices:

Price list of sashes, doors, moldings, etc., 1911.
Torroba-box catalogue.
Bolinders' catalogue of sawmill machinery.

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